SERVICE DATA
FILE NO. 300 - 950

TOSHIBA

SUPER MULTI AIR CONDITIONER
(COOL/HEAT FLEX SERIES)

Outdoor Units

MAR-F81HTM8
MAR-F101HTM8

Multi-Controller

RBM-Y1031FE
RBM-Y1041FE

TABLE OF CONTENTS

1. MULTI AIR CONDITIONER SYSTEMS AND THEIR BASIC COMPONENTS 2
   - 1-1. Indoor Remote Controllers 3
   - 1-2. Outdoor Units 3
   - 1-3. Multi-controllers 3
   - 1-4. Indoor Units 3
2. CONTROL SYSTEM 3
3. REFRIGERANT CYCLE DIAGRAM 5
4. COMBINATION OF INDOOR UNITS AND OUTDOOR UNITS 6
   - 4-1. Basic Criteria for Combinations 6
   - 4-2. Procedure for Checking the Combination 7
   - 4-3. Examples of Connection Check 8
5. SPECIFICATIONS OF OUTDOOR UNIT 9
   - 5-1. Explanation of Electric Characteristics Calculation 10
6. EXTERNAL VIEW 11
   - 6-1. Outdoor Unit 11
   - 6-2. Multi-controller 12
   - 6-3. Header 13
7. WIRING DIAGRAM 14
   - 7-1. Outdoor Unit (MAR-F81HTM8, MAR-F101HTM8) 14
   - 7-2. Multi-controller (RBM-Y1031FE, Y1041FE) 16
8. ELECTRICAL SPECIFICATIONS 18
   - 8-1. Specifications of Refrigerant Cycle Parts 18
   - 8-2. Specifications of Inverter Assembly Parts 19
   - 8-3. Specifications of Multi-controller Parts 20
9. Cooling/Heating Capacity Characteristics 21
   - 9-1. Range of Operation 21
   - 9-2. Cooling Capacity Calculation 22
   - 9-3. Heating Capacity Calculation 23
10. AIR TIGHTNESS TEST, AIR PURGING WITH A VACUUM PUMP AND CHARGING OF ADDITIONAL REFRIGERANT 25
    - 10-1. Air Tightness Test 25
    - 10-2. Air Purging with a Vacuum Pump 26
    - 10-3. Additional Refrigerant Charging and Amount of Addition 27
11. PIPING LENGTH AND CHARGED REFRIGERANT AMOUNT 28
    - 11-1. Main Branch (One Multi-Controller) 28
    - 11-2. Sub Branch (Two Multi-Controllers) 29
12. DESCRIPTION OF OPERATION 30
    - 12-1. Simultaneous Cooling/ Heating Operation Control Outline 30
    - 12-2. Functions and Operations of Solenoid Valves 31
13. OPERATIONS OF EACH SENSOR 33
    - 13-1. Multi-Controller 33
    - 13-2. Outdoor Unit 34
14. COOLING/HEATING AUTOMATIC REMOTE CONTROLLER 35
    - 14-1. Cooling/Heating Automatic Change-Over Operation 35
15. IMPORTANT MATTERS TO BE CHECKED BEFORE TEST RUN AND SERVICING 36
    - 15-1. Registered Indoor Unit Code Numbers 36
    - 15-2. Connections of Refrigerant Piping and Control Wires between Indoor Units and Multi-Controller 37
    - 15-3. Connections of Control Wires between Units 37
16. TEST RUN 38
    - 16-1. Test Run Procedure 38
    - 16-2. Check before Test Run 38
    - 16-3. Test Run Check 39
    - 16-4. Guidelines 41
17. SERVICING PROCEDURES 43
18. CHECK CODE DISPLAY SYSTEM CHART 45
19. IDENTIFICATION PROCEDURES 46
20. JUDGMENT OF MALFUNCTIONS WITH THE REMOTE CONTROLLER INDICATION 49
    - 20-1. Malfunction Check Display Operation 49
    - 20-2. How to Read the Malfunction Check Monitor Display 50
    - 20-3. The Check Code and the Judgment 51
    - 20-4. Malfunction Judgment with the Self-Diagnostic Function of the Outdoor Unit 57
    - 20-5. Malfunction Judgment with the Self-Diagnostic Function of the Multi-Controller 64
    - 20-6. PMV Opening Degree, Temperature Sensor and Pressure Sensor Data Code Display Conversion Table 67
21. OTHERS 71
    - 21-1. Microprocessor System Diagram and the Time Required to Judge the Malfunction 71
    - 21-2. A Check of the Control Circuit Power Voltage of the Multi-Controller Control Board 72
    - 21-3. A Check of the Control Circuit Power Voltage of the Outdoor Interface Board 73
    - 21-4. 220 – 240V System Diagram 74
22. REMOTE CONTROLLER DISCRIMINATION FUNCTION, OUTDOOR UNIT DISCRIMINATION FUNCTION 76
    - 22-1. Search from the Remote Controller 76
    - 22-2. Search from Outdoor Unit 76
23. CHECK FOR REFRIGERANT PIPING AND INTER-UNIT WIRING CONNECTION 77
    - 23-1. Check System Procedures 77
24. REMOVAL METHOD 78
    - 24-1. Outdoor Unit (MAR-F81HTM8, F101HTM8) 78
    - 24-2. Multi-Controller (RBM-Y1031FE, Y1041FE) 83
25. EXPLODED VIEWS AND PARTS LIST 86
    - 25-1. Outdoor Units (MAR-F81HTM8, MAR-F101HTM8) 86
    - 25-2. Electrical Parts Assembly (MAR-F81HTM8, MAR-F101HTM8) 88
    - 25-3. Multi-Controller (RBM-Y1031FE, RBM-Y1041FE) 90
    - 25-4. Electrical Parts Assembly (RBM-Y1031FE, RBM-Y1041FE) 91

1. MULTI AIR CONDITIONER SYSTEMS AND THEIR BASIC COMPONENTS

These multi air conditioner systems allow separate operation of each indoor unit in both heating and cooling simultaneously.

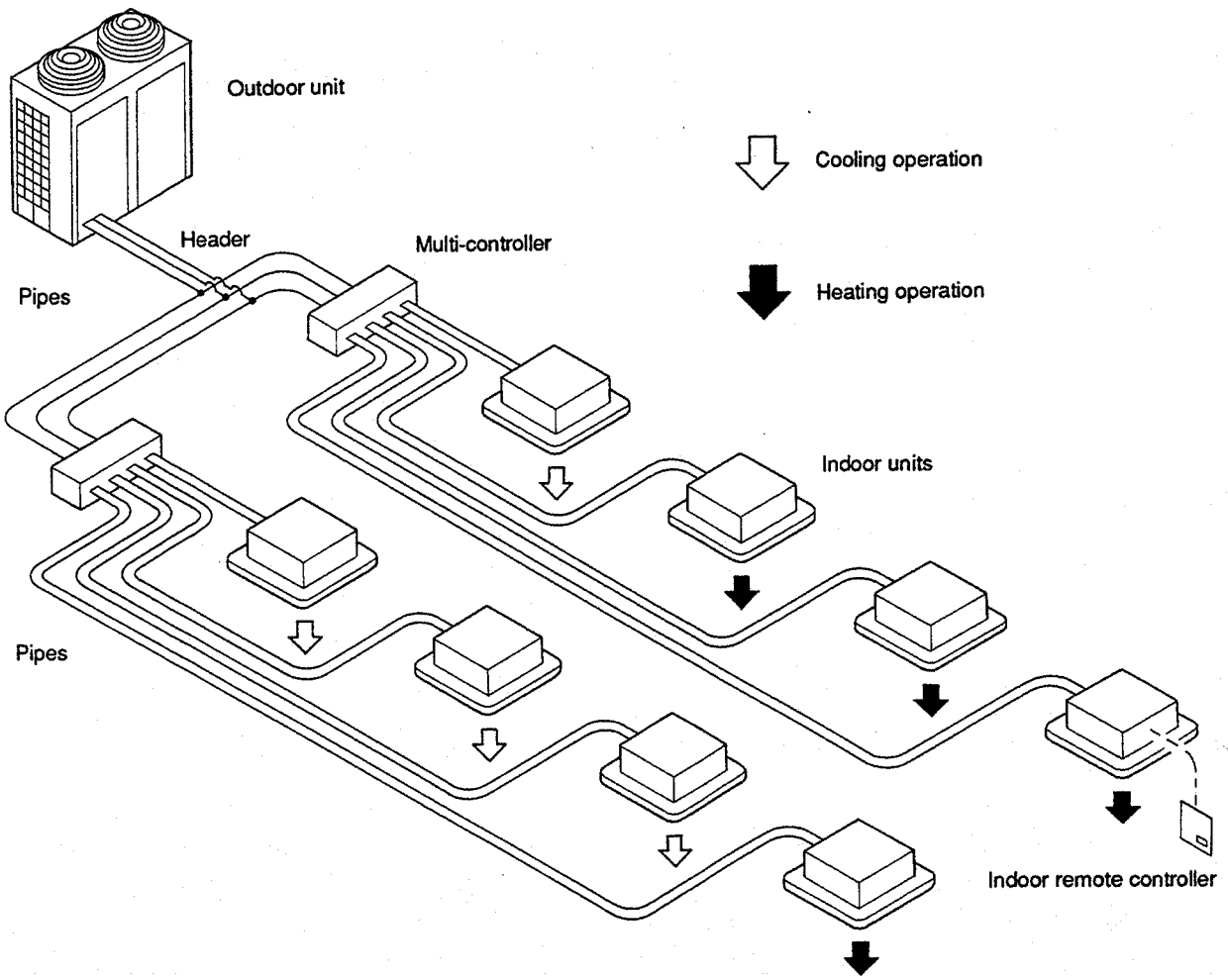


Fig. 1-1

Danger: Be sure to provide a ventilator in a room, because;
This multi air conditioner system contains a large amount of refrigerant (HCFC 22). In the worst case of a refrigerant leakage from a indoor unit, a room equipped with the indoor unit is filled with a large volume of refrigerant gas.
Consequently, people or animals in the room may be suffocated by lack of oxygen.

1-1. Indoor Remote Controllers

Indoor remote controllers come either with or without the automatic heating/cooling mode function. Automatic heating and cooling operations can be controlled by those that equipped with the function.

1-2. Outdoor Units

Two types of outdoor units are available in the line-up: 8 HP and 10 HP. For 16 HP or larger applications, both types are used in combination.

1-3. Multi-controllers

Multi-controllers are refrigerant distributing devices to connect multiple indoor units with the outdoor unit. The series includes 3-way (for 3 indoor units)and 4-way multi-controllers. To make a 5-, 6-, 7- or 8-way (for 8 indoor units) system, the 3-way and 4-way multi-controllers are used in combination with a header.

1-4. Indoor Units

There is a wide range of indoor units totaling 13 models (3 types with 6 capacity ratings from 1.5 to 5 HP). Refer to table 4-1.

2. CONTROL SYSTEM

The refrigerant and electrical systems of the multi air conditioner system are controlled by the multi-controllers and microprocessor contained inside the outdoor unit. The indoor units of the Cool/Heat Flex Series of Multi Air Conditioner Systems are the same units as in the RAV-series air conditioner systems.

For system operation, first the microprocessor in each indoor unit reads the difference between the current room temperature and desired temperature which has been set by the remote controller, determines the corresponding demand signal, and transmits this to the multi-controller microprocessors in the form of operation commands (ON/OFF, cooling/heating operation mode, operation frequency of the compressor).

On the basis of the operation commands sent from all the indoor microprocessors, the multi-controller microprocessors adjust the cooling and heating operation commands and send them to the interface microprocessor in the outdoor unit. The interface microprocessor calculates the capacity required for cooling and heating, determines the operation mode in the outdoor unit and calculates frequencies of the compressor and all the requested heating command difference between all the requested cooling command frequencies of the compressor of all the indoor units.

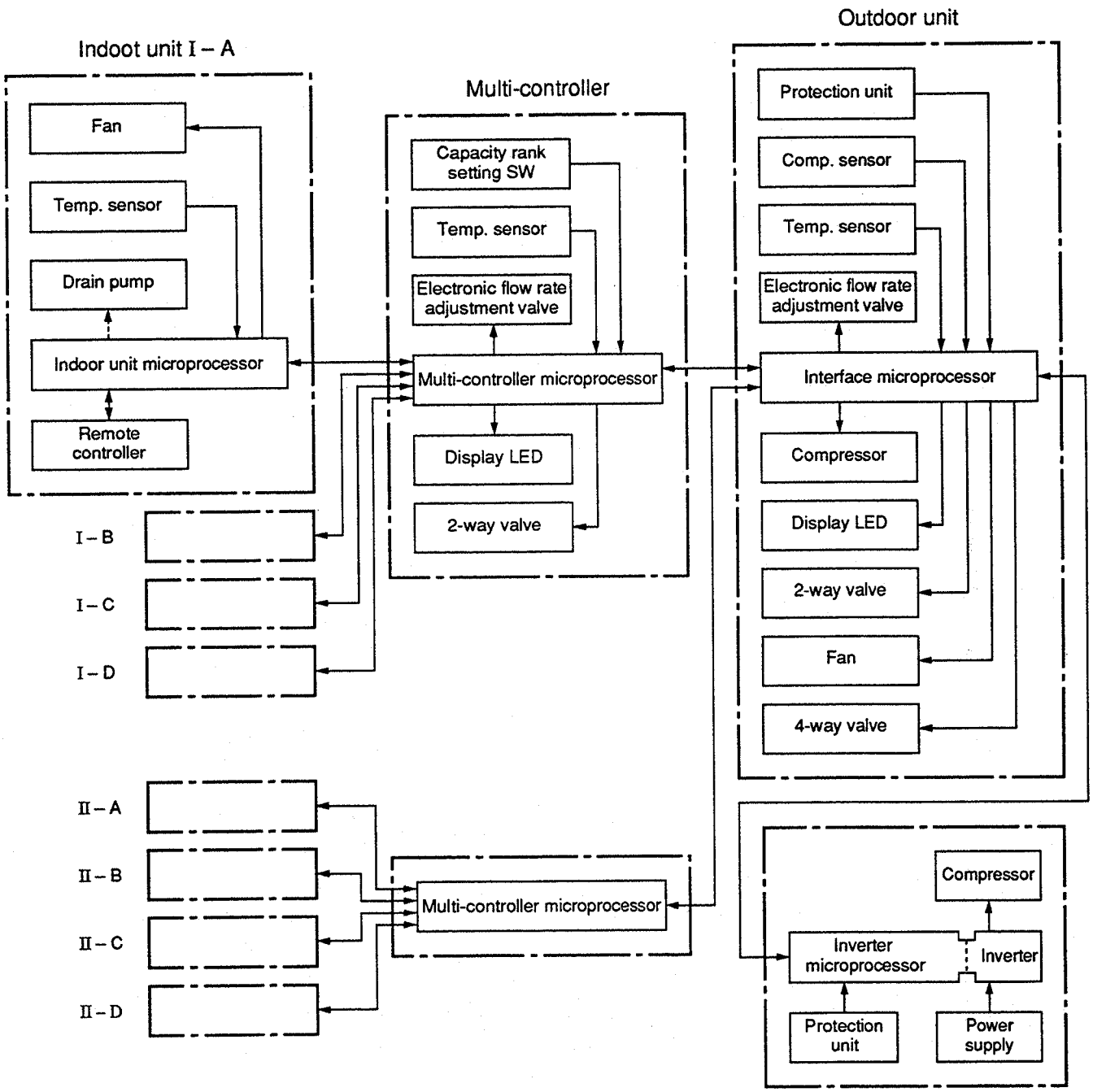

Indoot unit I – A
Fan
Temp. sensor
Drain pump
Indoor unit microprocessor
Remote controller
I – B
I – C
I – D
Multi-controller
Capacity rank setting SW
Temp. sensor
Electronic flow rate adjustment valve
Multi-controller microprocessor
Display LED
2-way valve
Outdoor unit
Protection unit
Comp. sensor
Temp. sensor
Electronic flow rate adjustment valve
Interface microprocessor
Compressor
Display LED
2-way valve
Fan
4-way valve
II – A
II – B
II – C
II – D
Multi-controller microprocessor
Compressor
Inverter microprocessor
Inverter
Protection unit
Power supply

Fig. 2-1

3. REFRIGERANT CYCLE DIAGRAM

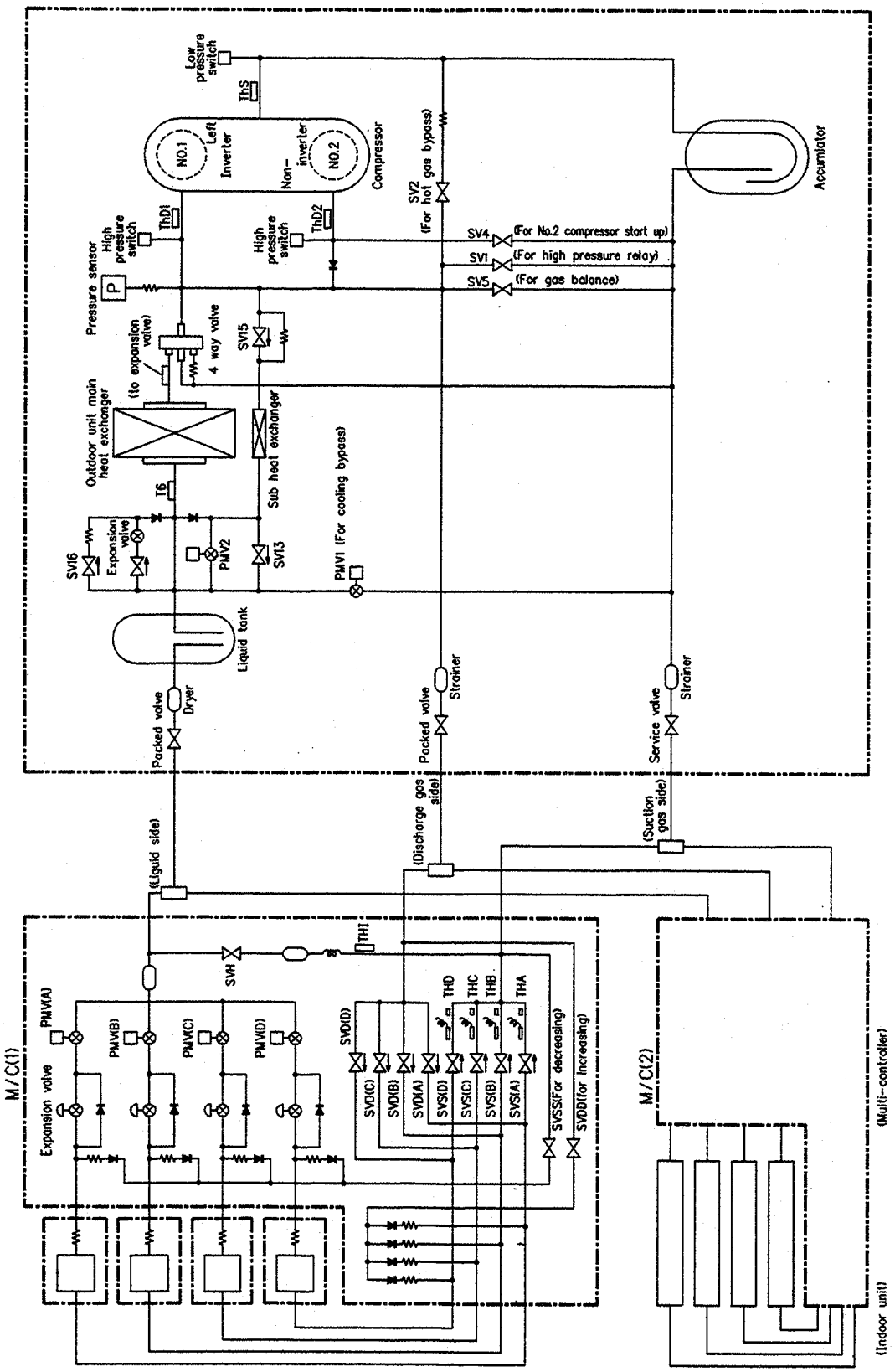


Fig. 3-1 Examples of 8 and 10 HP

4. COMBINATION OF INDOOR UNITS AND OUTDOOR UNITS

4-1. Basic Criteria for Combinations

(1) For details of indoor units to be connected, refer to the each Service Data for indivisual RAV-series split system air conditioner.

Table 4-1 Available indoor unit model name and service data file number

Capacity Rank / Type	130	160	200	260	360	460
Wall	———	RAV-160KH-P No. 300-885	RAV-200KH No. 300-855	RAV-260KH-P No. 300-885	———	———
Cassette	RAV-130UH-P No. 300-949	RAV-160UH-P No. 300-883	———	RAV-260UH-P No. 300-883	RAV-360UH-P No. 300-881	RAV-460UH-P No. 300-881
Duct	———	RAV-160BH No. 300-842	RAV-200BH No. 300-842	RAV-260BH-P No. 300-920	RAV-360BH-P No. 300-920	RAV-460BH-P No. 300-920

(2) The indoor units have code numbers according to their capacity ranks. (See Table 4-2.)

Table 4-2 Code numbers of indoor units

Capacity Rank of Indoor Unit	Code No.
130	3
160	4
200	4
260	5
360	8
460	10

(Ex. Model RAV-360UH-P → Capacity rank 360)

(3) Indoor units within a determined range of codes can be connected to the outdoor units (minimum code and maximum value of code number total). (See Table 4-3.)

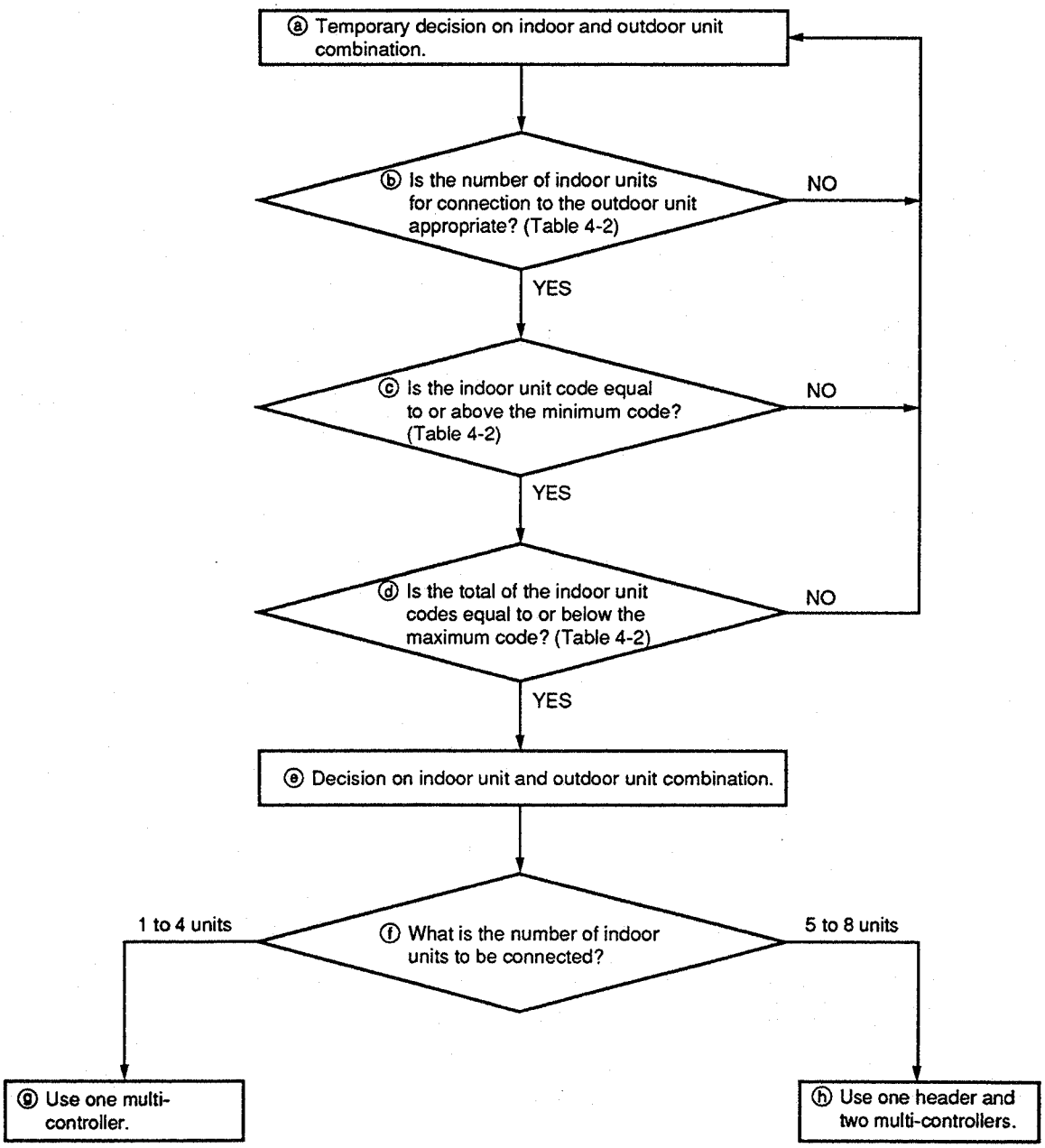
Table 4-3 Code of outdoor units

Items / Equivalent HP	Max. Connected Unit	Min. Code	Max. Code
8 HP (MAR-F81HTM8)	7	3	21
10 HP (MAR-F101HTM8)	8	3	27

(4) Only one multi-controller is needed when using up to four indoor units, but for five to eight indoor units, the system is divided into two parts and a multi-controller is connected to each, so two multi-controllers are necessary.

Note: It is possible to connect indoor units with a total capacity exceeding the capacity of the outdoor unit (by a maximum of 135%), but the maximum capacity at which operation is possible at any given time is the maximum capacity of the outdoor unit.

4-2. Procedure for Checking the Combination


ⓐ Temporary decision on indoor and outdoor unit combination.
ⓑ Is the number of indoor units for connection to the outdoor unit appropriate? (Table 4-2)
NO
YES
ⓒ Is the indoor unit code equal to or above the minimum code? (Table 4-2)
NO
YES
ⓓ Is the total of the indoor unit codes equal to or below the maximum code? (Table 4-2)
NO
YES
ⓔ Decision on indoor unit and outdoor unit combination.
ⓕ What is the number of indoor units to be connected?
1 to 4 units
5 to 8 units
ⓖ Use one multi-controller.
ⓗ Use one header and two multi-controllers.

Note: A multi-controller is necessary even when only using one indoor unit.
For each procedure in the above flow chart, please refer to Fig. 4-1.

4-3. Examples of Connection Check

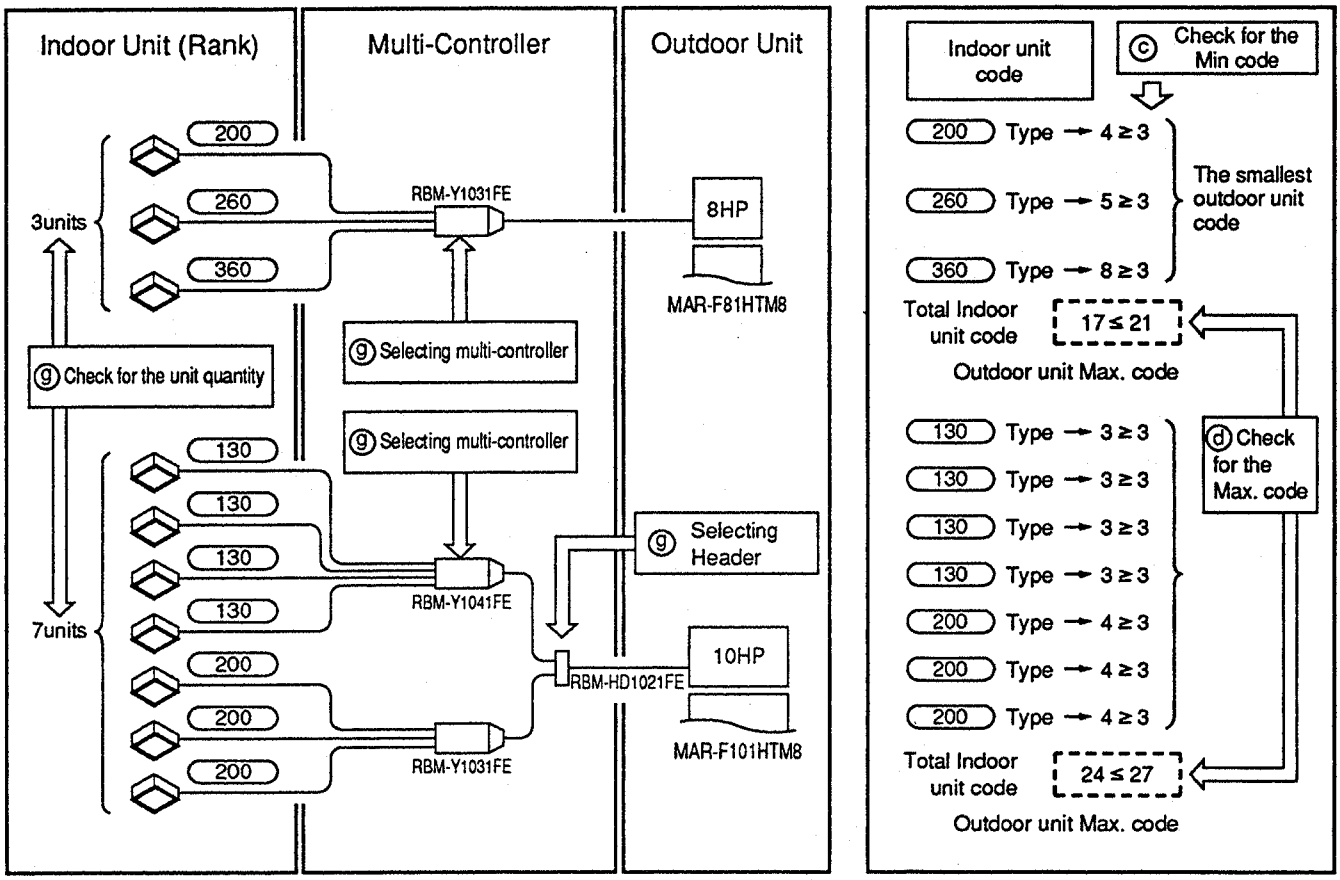


Fig. 4-1

5. SPECIFICATIONS OF OUTDOOR UNIT

Table 5-1

Model Name			MAR-F81HTM8	MAR-F101HTM8
Cooling capacity (★1)		(kcal/h)	18,000 (20,000)	22,500 (25,000)
Heating capacity (★1)		(kcal/h)	18,600 (23,200)	23,200 (29,000)
Power supply (★2)			3-phase 380 – 415V 50Hz	
Cooling	Operating current	(A)	12.3 (14.0)	15.7 (17.2)
	Power consumption	(kW)	8.0(9.2)	10.1 (11.5)
	Power factor	(%)	94 (95)	93 (96)
Heating	Operating current	(A)	11.7 (15.3)	15.0 (20.0)
	Power consumption	(kW)	7.7 (10.1)	10.1 (13.6)
	Power factor	(%)	95 (95)	97 (98)
Starting current		(A)	60	
Starting method			Direct	
Dimensions (H x W x D)		(mm)	1,490 x 1,290 x 750	1,490 x 1,290 x 750
Net weight		(kg)	330	340
Finished color			Silky gray (Munsell 6Y7/0.3)	
Compressor	Type		Hermetically sealed	
	Motor output	(kW)	5.6	7.5
Fan unit	Fan		Propeller fan	
	Motor output	(kW)	0.15 x 2	
	Air flow volume	(m^3/h)	10,000	
Refrigerant (charged weight)		(kg)	R-22 (17.6)	R-22 (21.6)
Discharge gas side		(mm)	ø19	
Liquid side		(mm)	ø15.9	
Suction gas side		(mm)	ø25.4	ø28.6
Coupler style			Flare connection (liquid side/discharge gas side), Brazing connection (suction gas side)	
Max. equivalent piping length		(m)	120	
Max. actual piping length		(m)	100 : The equivalent length is the base if there are too many bends.	
Max. piping head		(m)	50: In case of outdoor unit installed above, 20: In case of outdoor unit installed below.	
Crank case heater		(W)	74	

Note: ★1: Cooling/Heating capacity is based on JIS B 8615. The value marked by ( ) means operation at maximum capacity.

★2: Power voltage, if it varies, should be within a 10% range.

Specifications are subject to change without notice.

5-1. Explanation of Electric Characteristics Calculation

Calculate with the formulas below seeing Table 5-2.

Total input $P_T = \Sigma P$ (kW)

Total current $I_T = \sqrt{(\Sigma I_P)^2 + (\Sigma I_V)^2}$ (A)

Total power factor $f = \Sigma I_P / I_T \times 100$ (%)

Table 5-2

Model Name			**MAR-F81HTM8**	**MAR-101HTM8**
Cooling	Power consumption P	(kW)	8.0 (9.2)	10.1 (11.5)
	Effective current I_P	(A)	11.6 (13.3)	14.6 (16.5)
	Ineffective current I_V	(A)	4.1 (4.4)	5.8 (4.9)
Heating	Power consumption P	(kW)	7.7 (10.1)	10.1 (13.6)
	Effective current I_P	(A)	11.1 (14.5)	14.6 (19.6)
	Ineffective current I_V	(A)	3.7 (4.9)	3.4 (4.0)

Note: The value marked by ( ) means operation at maximum capacity.

Example: MAR-F81HTM8 x 1 unit + MAR-F101HTM8 x 3 units

Rated value at cooling operation:

Total input $P_{T1} = 8.0 + 10.1 \times 3 = 38.3$ (kW)

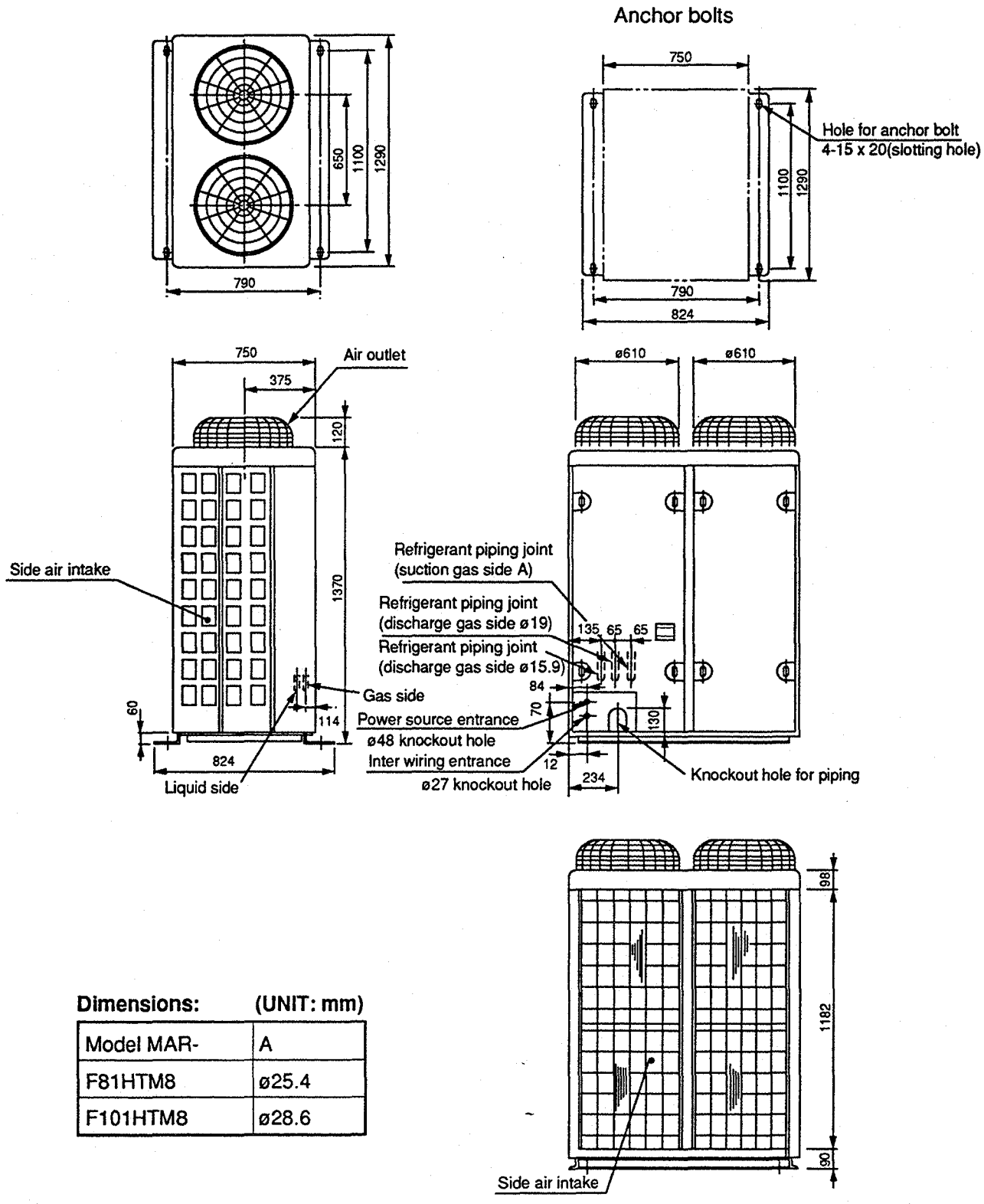
Total current $I_{T1} = \sqrt{(11.6 + 14.6 \times 3)^2 + (4.1 + 5.8 \times 3)^2} = 59.4$ (A)

Total power factor $f = (11.6 + 14.6 \times 3) \times 100 / 59.4 = 93$ (%)

Like this, calculate the maximum value at cooling operation, both rated and maximum value at heating operation by turns.

6. EXTERNAL VIEW

6-1. Outdoor Unit



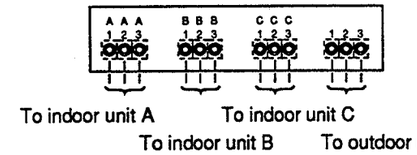
Dimensions: **(UNIT: mm)**

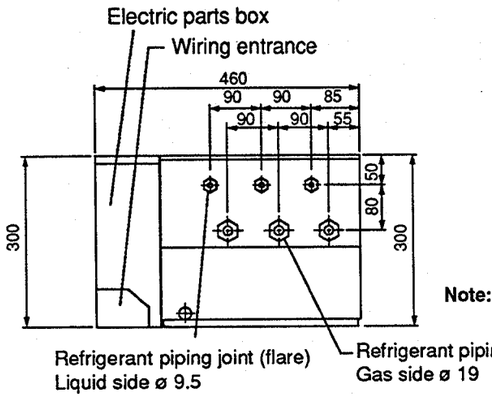
Model MAR-	A
F81HTM8	ø25.4
F101HTM8	ø28.6

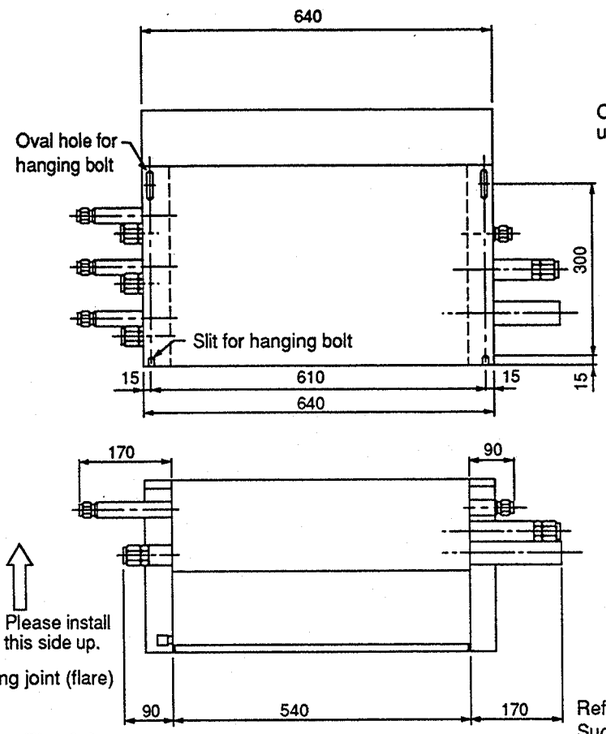
Fig. 6-1

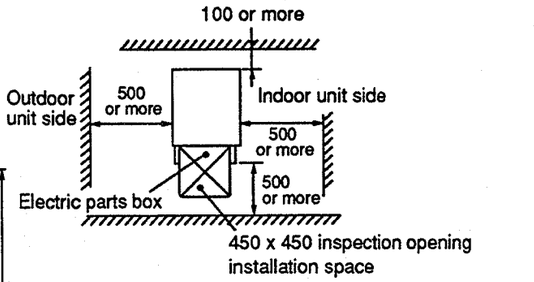
6-2. Multi-controller

RBM-Y1031FE









Note: Make an inspection opening at the specified place.
It is indispensable for test run and servicing.

Recommended size:
450mm x 450mm over

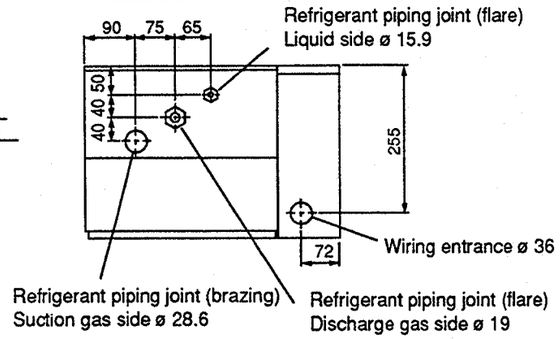
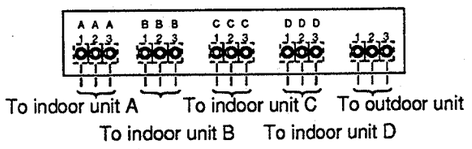
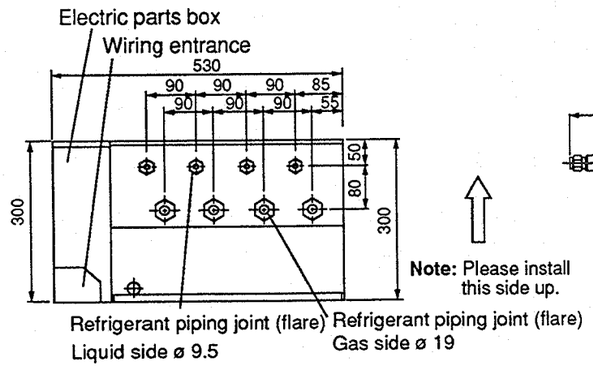
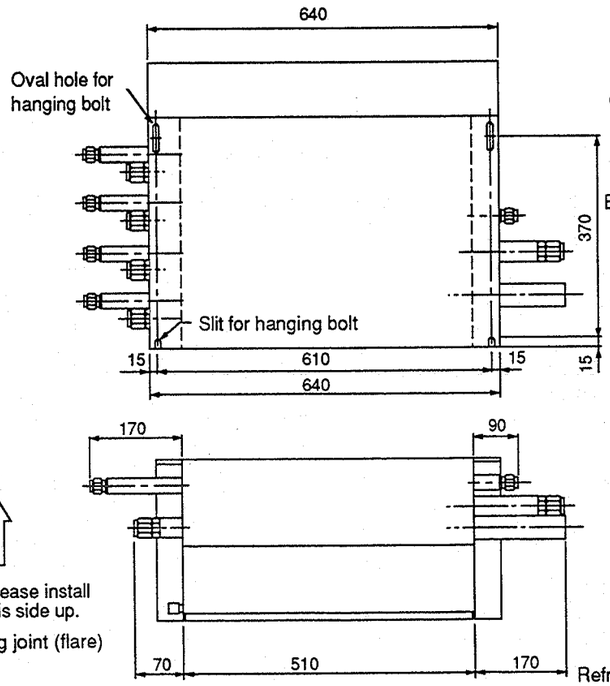


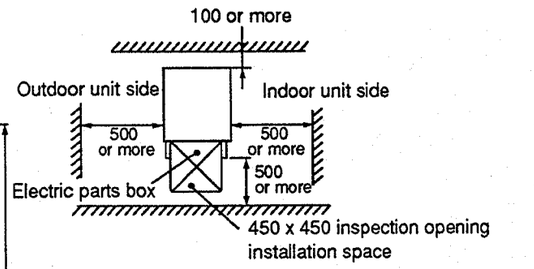
Fig. 6-2

RBM-Y1041FE









Note: Make an inspection opening at the specified place.
It is indispensable for test run and servicing.

Recommended size:
450mm x 450mm over

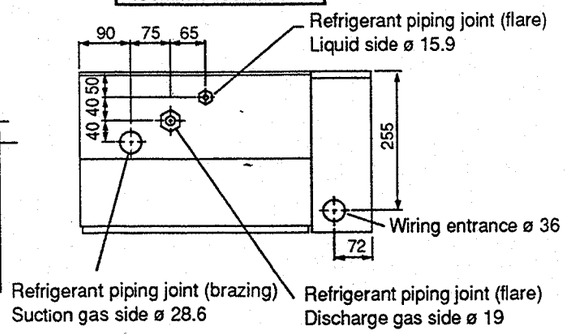


Fig. 6-3

6-3. Header

RBM-HD821FE, RBM-HD1021FE

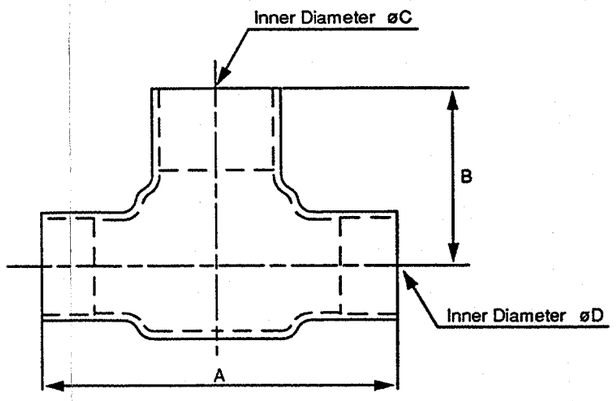


Fig. 6-4

Table 6-1 Dimensions

Type RBM-		A	B	C	D
RBM-HD821FE	Discharge gas side	60	30	19.1	15.9
	Suction gas side	74	37	25.5	19.1
	Liquid gas side	44	23	15.9	12.8
RBM-HD1021FE	Discharge gas side	60	30	19.1	15.9
	Suction gas side	82	41	28.7	19.1
	Liquid gas side	44	23	15.9	12.8

Table 6-2

Distribution	2-way	
Model name	RBM-HD821FE	RBM-HD1021FE
Outdoor unit to be connected	MAR-F81HTM8 (8 HP)	MAR-F101HTM8 (10 HP)

7. WIRING DIAGRAM

7-1. Outdoor Unit (MAR-F101HTM8/MAR-F81HTM8)

Symbol	Product
CM 1,2	Compressor
FM 1,2,3	Fan motor
52C 1,2,3	Electromagnetic contactor for compressor
49C 1,2	Inner overload relay
51C 3	Overload relay
PMV 1,2	Electronic flow control valve
63H 1,2	High pressure switch
RC 1,2	Running capacitor
SV 1,2,4,5,13,15,16	2-way valve
20SF	4-way valve
63L	Low pressure switch
CH	Crank case heater
Tr 1,2	Transformer
47C	Return Lock
LD 71,72,73,74	Fault indicator lamp
Th D1,D2,S,E,O	Temperature sensor
CD 1,2	Current detector

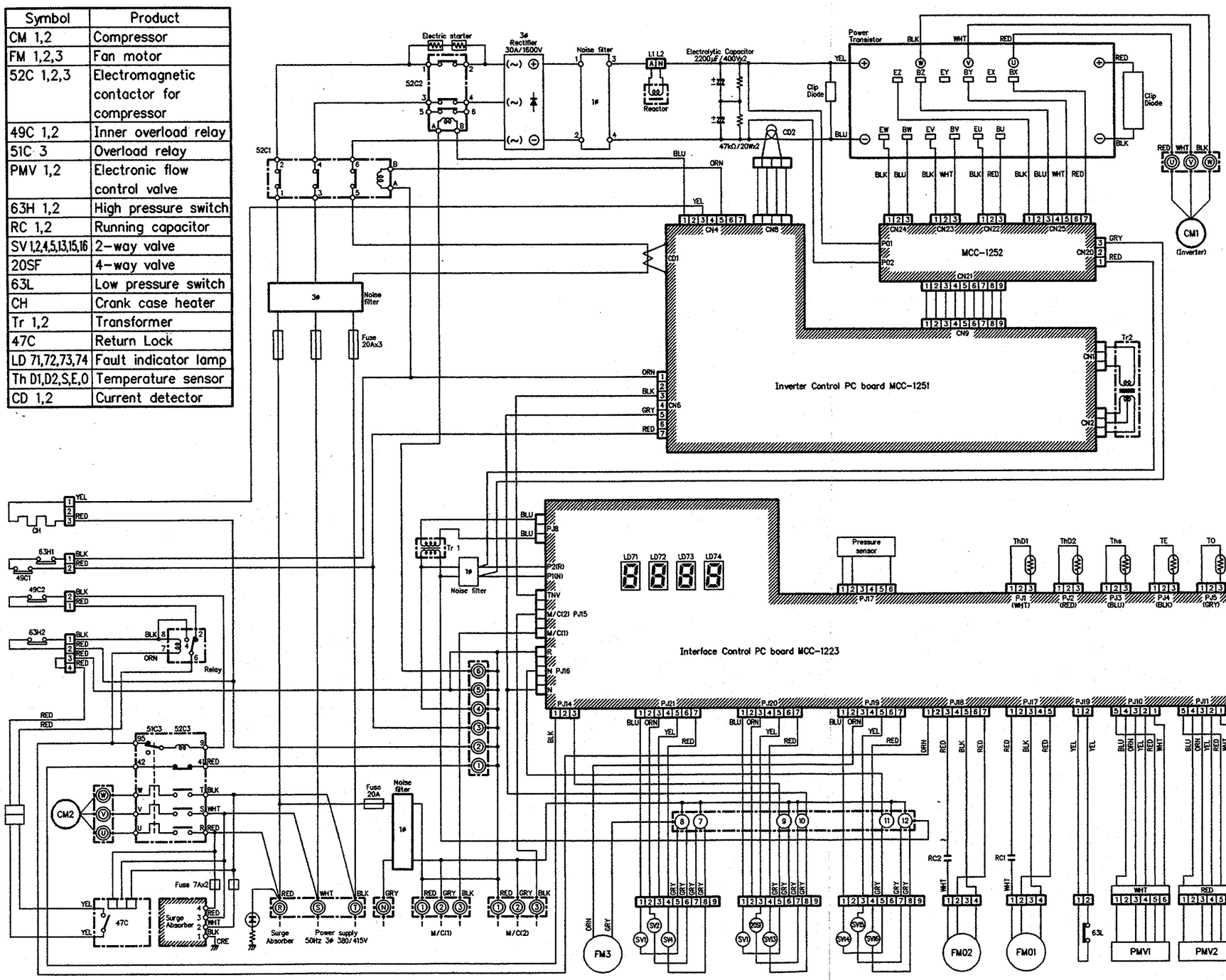


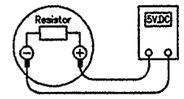
Fig. 7-1

Notes

1. The dashed line and two-dot-dash line indicate wiring on site.
2. ◎ and □ indicate terminal block, and numbers within them are terminal numbers.
3. ▨ indicates a printed circuit board.

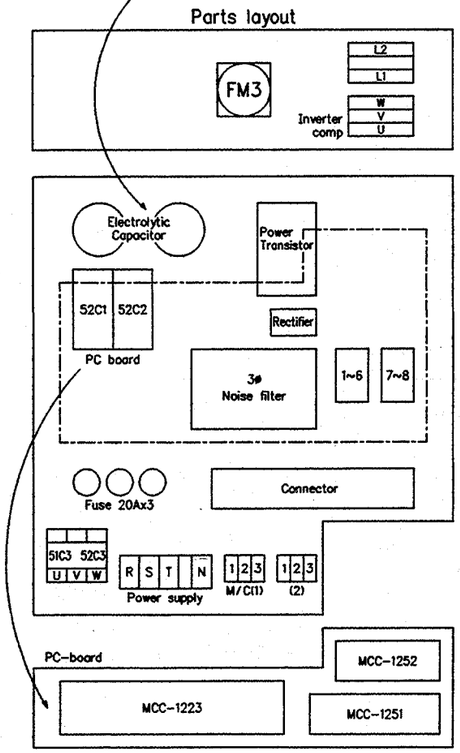
DANGER

THE ELECTROLYTIC CAPACITORS IN THIS PANEL ARE CHARGED TO 600 VOLTS D.C. BEFORE SERVICING, TURN OFF THE POWER SUPPLY AND ALLOW AT LEACT 20 MINUTES FOR THE CAPACITOR DISCHARGING TO A SAFE LEVEL OF 5 VOLTS D.C. OR LESS TO AVOID POSSIBLE HAZARD.
TEST WITH A D.C VOLTS METER AS SHOWN.

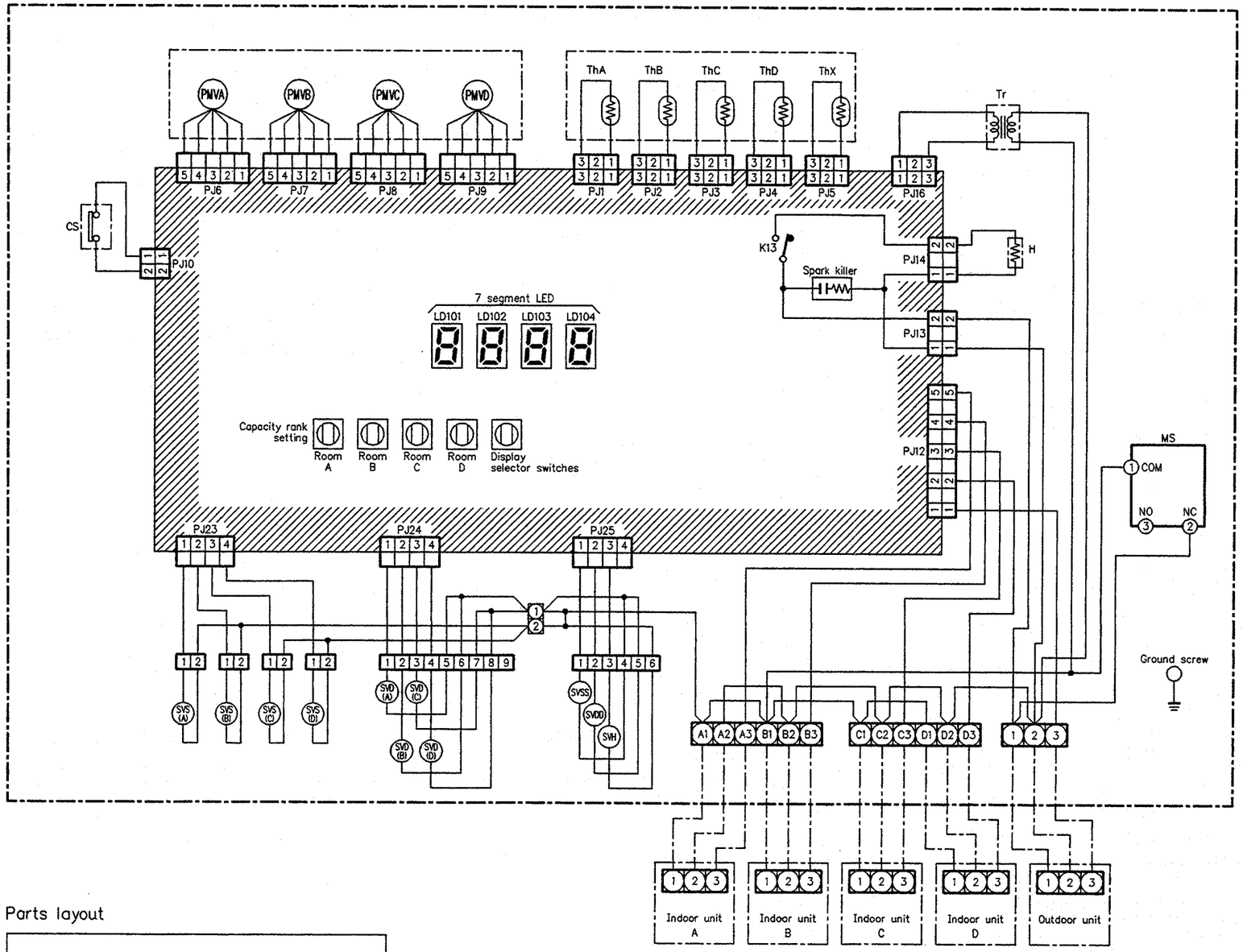


NEVER SHORT THE CAPACITOR TERMINALS WITH ANY METAL IMPLEMENT FOR DISCHARGING. PERSONAL INJURY OR EQUIPMENT DAMAGE MAY RESULT.

Parts layout



7-2. Multi-controller (RBM-Y1031FE, Y1041FE)

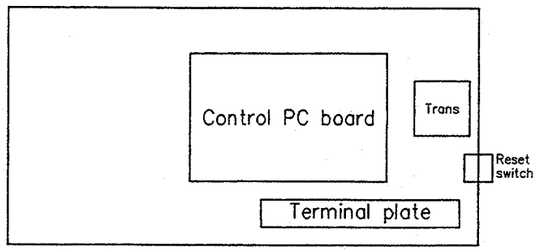


Remember:
For quick reference on connection between the multi-controller and indoor units, enter indoor unit models connected, installation locations, and code setting in the table below.

	Indoor unit model name	Installation location	Capacity rank code
Indoor unit A			
Indoor unit B			
Indoor unit C			
Indoor unit D			

1. ◎ and □ indicate terminal blocks, and numbers enclosed in them are terminal numbers.
2. The two-dot dash line indicates wiring on site.
3. ▨ indicates a printed circuit board.
4. The ⊏⊐ frame indicates the product body.
5. RBM-Y1031FE does not have PMVD, SVD(D) SVS(D), ⓓ — ⓓ, ThD and capacity rank code setting switch for room D.

Parts layout



Symbol	Product	Symbol	Product
PMV A,B,C,D	Flow control valve	SVD (A),(B),(C),(D)	Electrically operated valve of discharge gas side
Th A,B,C,D,X	Temperature sensor	SVS (A),(B),(C),(D)	Electrically operated valve of suction gas side
Tr	Power transformer	SVDD	Electrically operated valve for pressure raising
CS	Float switch	SVSS	Electrically operated valve for pressure decreasing
H	Heater	SVH	Electrically operated valve for superheat control
MS	Reset switch	LD101,102,103,104	Fault indicator lamp

8. ELECTRICAL PARTS SPECIFICATIONS

8-1. Specifications of Refrigerant Cycle Parts

Model Name			MAR-F81HTM8	MAR-F101HTM8
Comp-ressor motor	Model name		HV990CW-Y12	HV1200CW-Y12
	Motor type		3-phase induction motor	
	Power supply		3-phase, 380 – 415V, 50Hz	
	Output	(kW)	5.6	7.5
	Pole	(P)	2/2 (Inverter side/Non-inverter side)	
	Coil resistance	(Ω)	1.49/2.51 (Inverter side/Non-inverter side)	
	Compressor oil name		SUNISO 3GSD	
	Amount of oil		7,000cc	
Blower motor	Model name		STF-200-150C	
	Motor type		1-phase, induction motor	
	Power supply		1-phase, 220 – 240V, 50Hz	
	Output	(W)	150	
	Power supply	(A)	1.12/1.44	
	Pole	(P)	6	
	Inner over-load relay		OFF:115 ± 5°C	
High pressure switch	Model name		20PS-B/20PS-G (Inverter side/Non-inverter side)	
	Operating pressure	(kg/cm^2G)	OFF: 30, ON: 23/OFF:23, ON: 30	
Low pressure switch	Model name		20PS-1	
	Operating pressure	(kg/cm^2G)	ON: 1.5, OFF: 0.25	
4-way valve			V25-760B	
Compressor case heater			AC240V, 74W	
Pressure sensor			Model name: 2S5F-A1 Input voltage: DC 12V Output voltage: DC 0.5 – 4.5V	
Discharge temperature sensor			25°C: 50kΩ, 50°C: 17.9kΩ, 100°C: 3.35kΩ	
Suction temperature sensor			0°C: 32.8kΩ, 25°C: 10kΩ, 50°C: 3.6kΩ	
Outdoor air temperature sensor			0°C: 32.8kΩ, 25°C: 10kΩ, 50°C: 3.6kΩ	
Flow rate adjustment valve			EV23RC2, Coil DC 12V	
Flow rate adjustment valve (for bypass)			EV18RC, Coil DC 12V	
2-way valve			(RP100-03), Coil AC 240V	
2-way valve			NEV202DXF, Coil AC 240V	

Specifications are subject to change without notice.

8-2. Specifications of Inverter Assembly Parts

Model Name	MAR-F81HTM8	MAR-F101HTM8
Power supply	3-phase, 380 – 415V, 50Hz	
Output voltage at operating frequency of 60Hz	AC 266V	
IGBT	MG50Q6ES11	
Relay	LY1F (AC 240V)	
Blower motor running capacitor	EAG45M605UF1,6μF450V	
Rectifier	30U6P42, 30A	
AC noise filter	ZSG2208-02, 8A, 250V	
DC noise filter	LF215AV, 15A, 716V	
Power supply rectifier capacitor	LNT2G222KSMCTF, 2200μF/400V	
Fuse	20A	
Electronic starter	912X25E101YV20	
Reactor	CH-26-T, 6.2mH, 18A	
Fan motor relay	G2R217PV	
Control relay	G4U-112P	
Magnetic contactor for compressor (Inverter side)	13A	
Magnetic contactor for compressor (Non-inverter side)	12A	15A
Transformer (Inverter)	FT57	
Transformer (Interface)	FT13-2	
Power supply terminal plate	AC600V, 60A	
PC board (Inverter)	MCC-1251	
PC board assembly (Interface)	MCC-1223	
Cooling fan	3650EXV-5, 220 – 240V	

Specifications are subject to change without notice.

8-3. Specifications of Multi-controller Parts

Model Name		RBM-Y1031FE	RBM-Y1041FE
Flow rate adjustment valve		EV23RC5, Coil DC 12V	
Temperature sensor		0°C: 32.8kΩ, 25°C: 10kΩ, 50°C: 3.6kΩ	
Float switch		FS-085-0031	
Power supply transformer	Model name	FT56	
	Specification	Primary side: AC 240V, Secondary side: AC 12V	
Relay (on PC board)		G2R-117P, Coil DC 12V	
Heater		10.4W/m	
		50W	65W
Temperature fuse for heater		OFF:119°C	
Power current fuse for heater		1A	
Discharge gas side solenoid valve		RP100-03, Coil AC 240V	
Suction gas side solenoid valve		REV-1506DXFQ6, Coil AC 240V	
2-way valve		NEV202DXF, Coil AC 240V	
2-way valve		NEV603DXF, Coil AC 240V	

Specifications are subject to change without notice.

9. Cooling/Heating Capacity Characteristics

9-1. Range of Operation

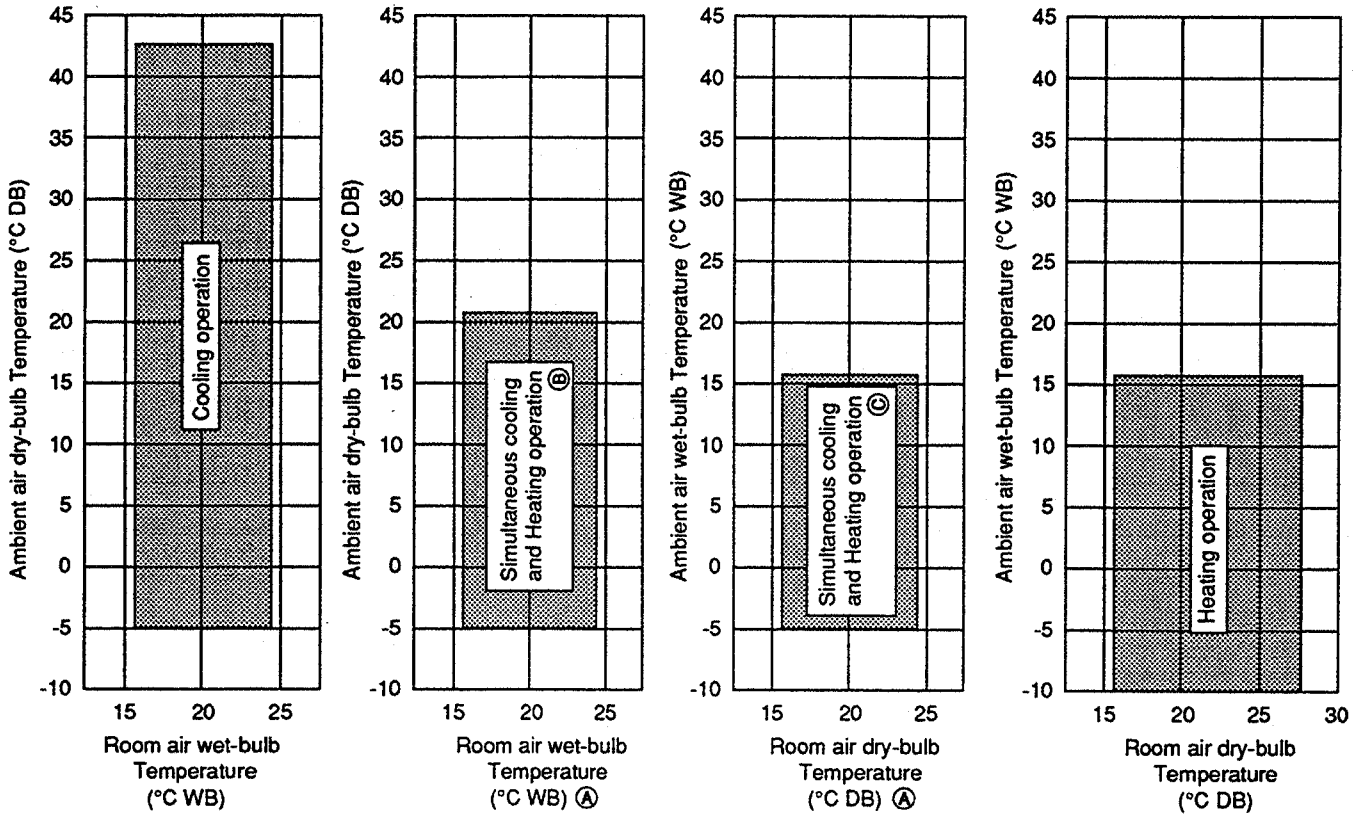


Fig. 9-1

Note: Ⓐ:Indicates the standard internal air temperature for the cooling operation. The internal air temperature range for the indoor unit during the heating operation is 15 to 28°C DB.
Ⓑ:When cooling load is higher and heat is being exhausted from the outdoor unit.
Ⓒ:When the heating load is higher and heat is being absorbed by the outdoor unit.

9-2. Cooling Capacity Calculation

Corrected cooling capacity = Standard cooling capacity x (① x ② x ③ x ④)

① Room Air Wet-Bulb Temperature Conditions and Capacity Correction Factor

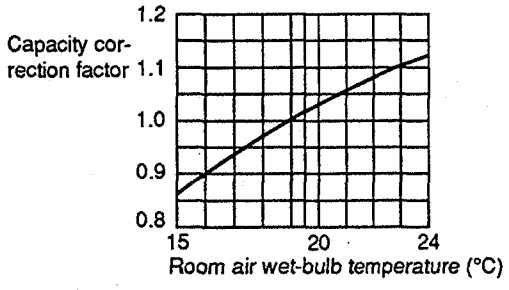


Fig. 9-2

② Indoor Unit Air flow Volume and Capacity Correction Factor (Built-in Duct Type Only)

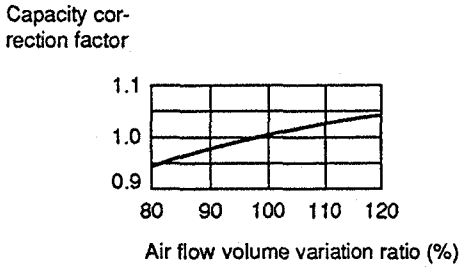


Fig. 9-3

③ Ambient Air Dry-Bulb Temperature and Capacity Correction Factor

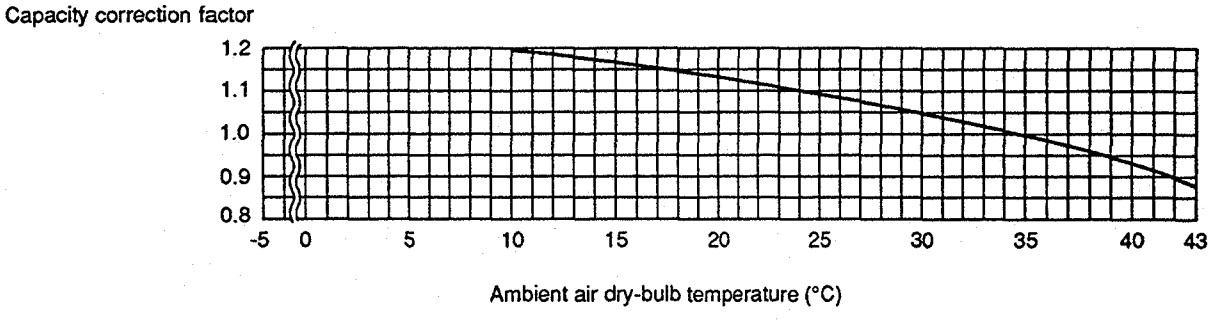
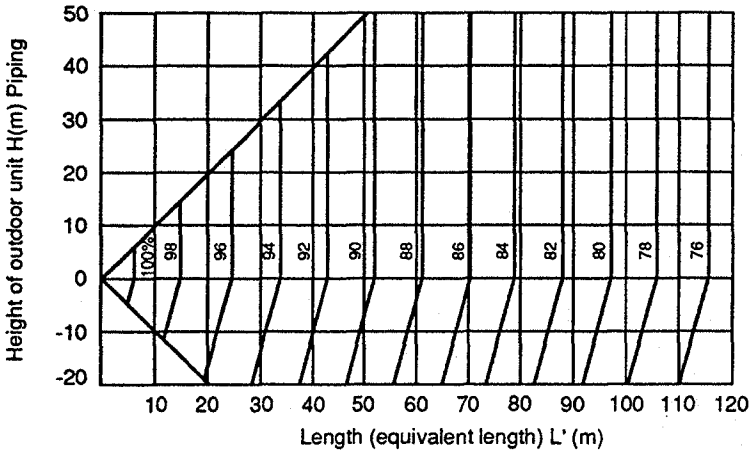
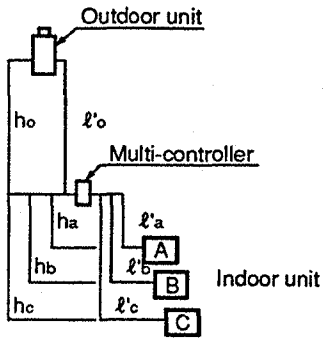


Fig. 9-4

④ Piping Head, Length and Capacity Correction Factor





L' is the longest one of ℓ'o + ℓ'a, ℓ'o + ℓ'b, ℓ'o + ℓ'c
H = ho + (largest one of ha, hb and hc)

Fig. 9-5

9-3. Heating Capacity Calculation

Corrected heating capacity = Standard heating capacity x (① x ② x ③ x ④)

① Room Air Dry-Bulb Temperature and Capacity Correction Factor

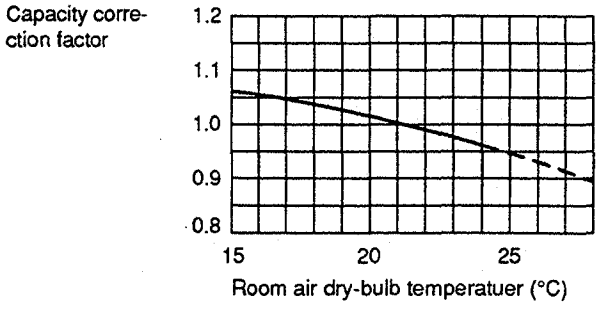


Fig. 9-6

② Ambient Air Wet-Bulb Temperature and Capacity Correction Factor

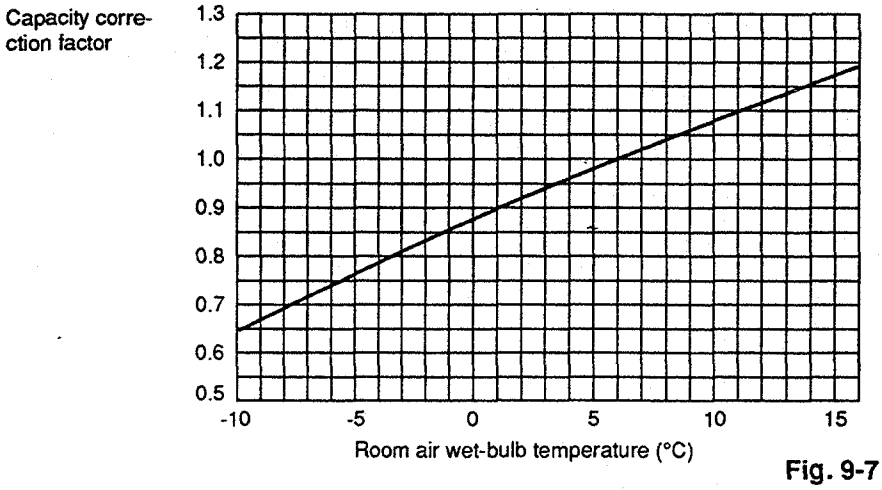


Fig. 9-7

③ Indoor Unit Air Flow Volume and Capacity Correction Factor (Only for Built-in Duct type)

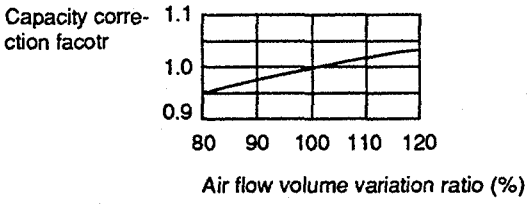
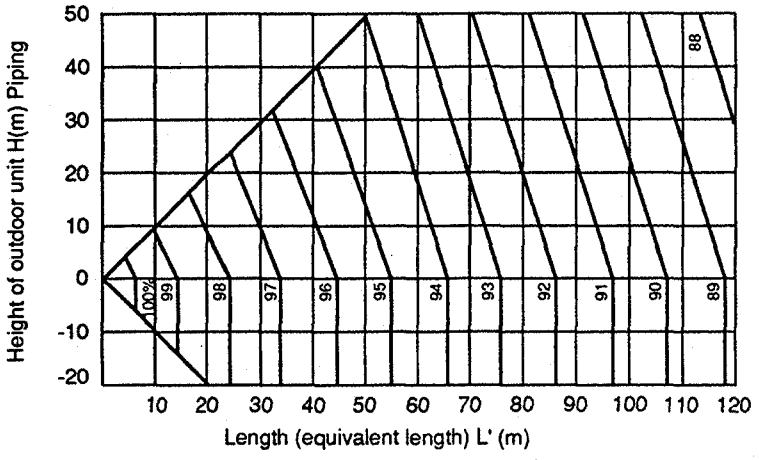
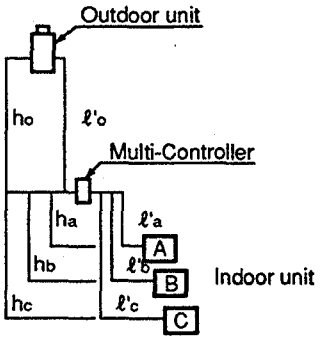


Fig. 9-8

④ Piping Head, Length and Capacity Correction Factor





L' is the longest one of $\ell'_o + \ell'_a$, $\ell'_o + \ell'_b$, $\ell'_o + \ell'_c$
H = h_o + (largest one of h_a, h_b and h_c)

Fig. 9-9

10. AIR TIGHTNESS TEST, AIR PURGING WITH A VACUUM PUMP AND CHARGING OF ADDITIONAL REFRIGERANT

Make sure to do the "Flushing" of the refrigerant pipes between indoor units and multi-controller, and multi-controller and outdoor unit.

After the flushing work is done, connect the pipes (liquid side, suction gas side, discharge gas side) and conduct the Air Tightness Test, Air Purging and Additional Refrigerant charge in turn.

10-1. Air Tightness Test

This test uses nitrogen gas under the pressure of 30 kg/cm^{2}G.

(1) Do not operate the packed valve or service valve until completion of air purging. (Leave the valves closed.)

(2) Air tightness test and air purging with a vacuum pump should be done before turning on the power.

(3) The gauge manifold's charge hose has a low pressure resistance, so always replace it with a copper pipe (ø6.4) for the test.

(4) Connect the copper pipe to the charge port of the suction gas pipe's service valve.

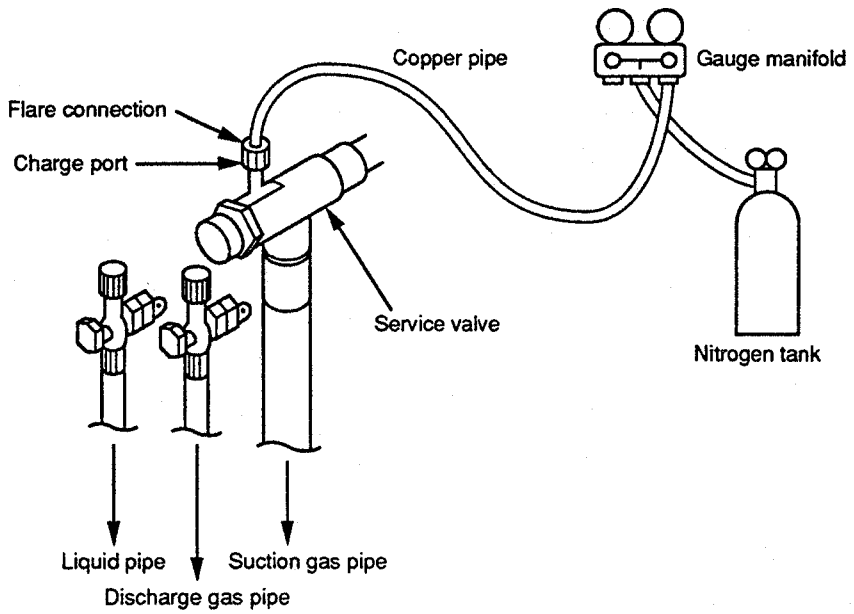


Fig. 10-1

Note: After connecting the copper pipe for charging, pressurize to 30 kg/cm^{2}G, let stand for one day, then check that there is no change in the gas pressure. If the gas pressure decreases, there may be a gas leak. The place(s) from where the gas is leaking should be checked.

10-2. Air Purging with a Vacuum Pump

(1) After completing the air tightness test, exhaust the nitrogen gas from the piping.

(2) Connect the charge hoses between the gauge manifold and the liquid pipe and discharge gas pipe's packed valve charge ports.

(3) Replace the nitrogen tank with the vacuum pump.

(4) Carry on air purging with the vacuum pump for at least 2 or 3 hours. When air purging is completed, close the gauge manifold's valve (Vd).

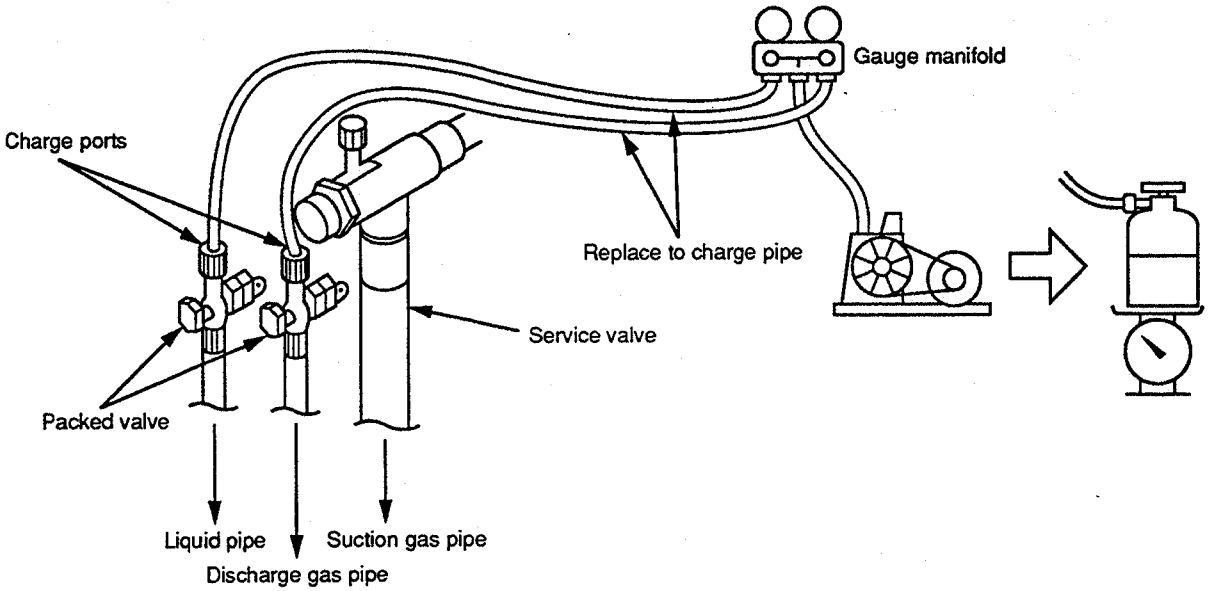


Fig. 10-2

Note:
1. To prevent leakage, we recommend you to use a pump with a large capacity and complete purging quickly.
2. Check that the gauge pressure is –76 cmHg.

10-3. Additional Refrigerant Charging

(1) Replace the vacuum pump with the refrigerant tank, charge the stipulated amount of refrigerant, and then open both packed valve and service valve fully. If additional charge is needed, conduct the following.

(2) Switch the charge hose to the suction gas pipe's service valve charge port (dotted lines → solid lines, one charge hose as shown in Fig. 10-3).

(3) Attach the charge hose lightly to the suction gas pipes service valve charge port at first and slightly loosen the refrigerant tank's valves (Va and Vb). The air in the tank's gas hose, gauge manifold and charge hose is expelled by the refrigerant.

(4) Next, tighten the hose fully, then loosen the service valve and use the pressure in the tank to add the specified amount of refrigerant. If not enough refrigerant can be added, operate the unit and draw in the refrigerant in gas form from the low pressure side to supply the specified amount.

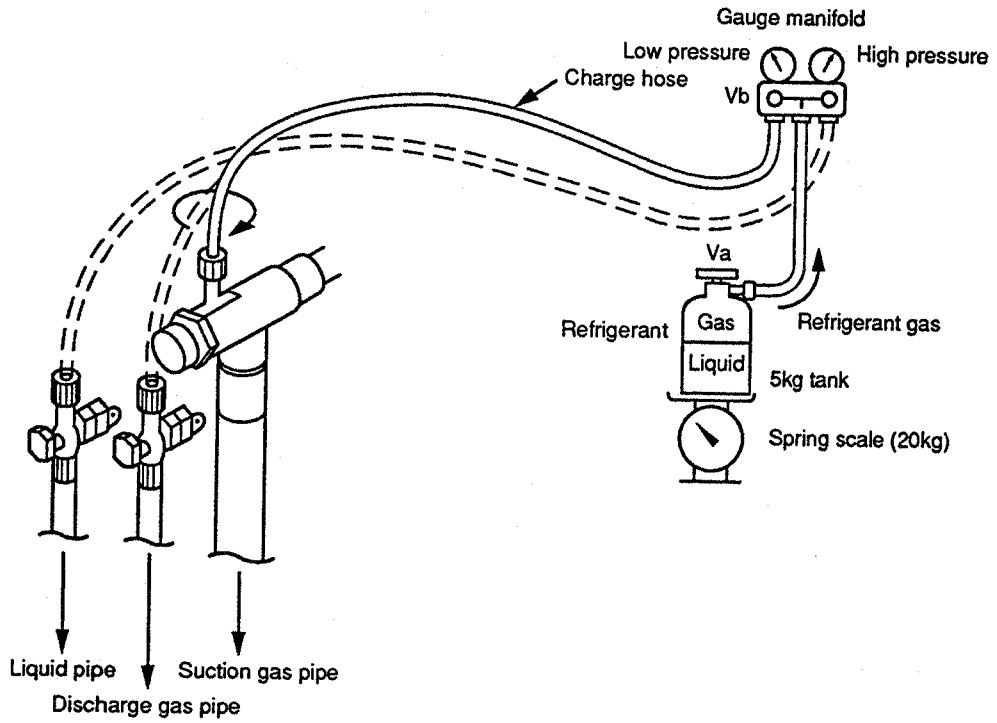


Fig. 10-3

11. PIPING LENGTH AND ADDITIONAL REFRIGERANT AMOUNT

11-1. Main Branch (One Multi-Controller)

At factory shipping, the "standard amount of refrigerant" corresponding to the "standard piping length is previously charged in outdoor unit. When the actual piping length exceeds the standard length, please add the supplemental refrigerant as follows.

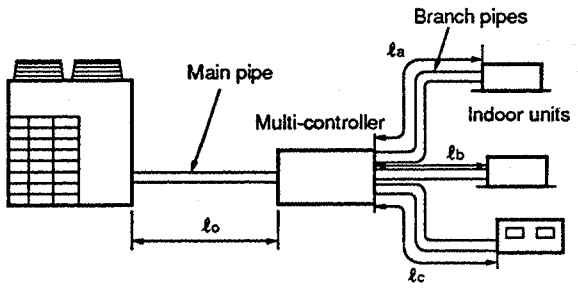


Fig. 11-1

Table 11-1

	ℓ_o (m)	$\ell_a, \ell_b, \ell_c, \ell_d$ (m)
Standard piping length	3	2

- Main pipe:Piping between outdoor unit and multi-controller.
- Branch pipe:Piping between multi-controller and each indoor unit.
- Amount of additional refrigerant (kg) = Additional amount of main pipe (kg) + additional amount of branch pipe (kg) = M x $(\ell_o - 3)$ + Na x $(\ell_a - 2)$ + Nb x $(\ell_b - 2)$ + Nc x $(\ell_c - 2)$ + Nd x $(\ell_d - 2)$

Table 11-2 Amount of additional refrigerant

Outdoor Unit	Indoor Unit Capacity Rank (Equivalent Horse Power to Multi Type)	Additional Amount	
		M (kg/m)	Na, Nb, Nc, Nd (kg/m)
MAR-F81HTM8 (Standard amount of refrigerant 17.6 kg)	130 (1.5 HP), 160 (2.0 HP), 200 (2.5 HP)	0.19	0.030
	260 (3 HP), 360 (4 HP), 460 (5 HP)		0.045
MAR-F101HTM8 (Standard amount of refrigerant 21.6kg)	130 (1.5 HP), 160 (2.0 HP), 200 (2.5 HP)	0.19	0.030
	260 (3 HP), 360 (4 HP), 460 (5 HP)		0.045

- M = Amount of additional refrigerant for every 1m of actual length of main pipe (The value varies depending on the type of outdoor unit.)
- Na, Nb, Nc, Nd = Amount of additional refrigerant for every 1m of actual length of branch pipe. (The value varies depending on the type of indoor unit.)

  ℓ_o = actual length of main pipe (m)

  $\ell_a, \ell_b, \ell_c, \ell_d$ = Actual length of branch pipe (m)

11-2. Sub Branch (Two Multi-Controllers)

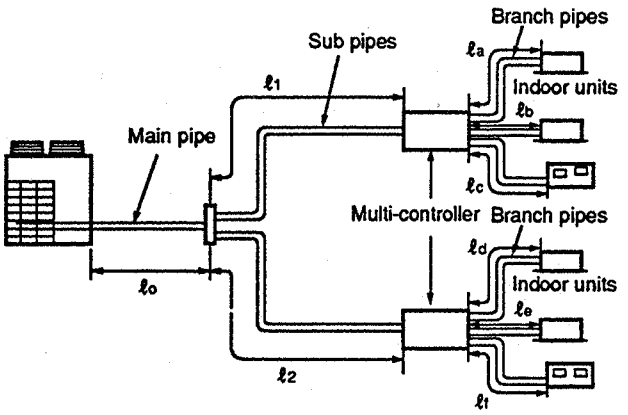


Fig. 11-2

Table 11-3

	ℓo (m)	ℓ1, ℓ2 (m)	ℓa, ℓb, ℓc, ℓd, ℓe, ℓf, ℓg, ℓh (m)
Standard piping length	2	1	2

- Main pipe:Piping between outdoor unit and header.
- Sub pipe:Piping between header and each multi-controller.
- Branch pipe:Piping between multi-controller and each indoor unit.
- Amount of additional refrigerant (kg) = Additional amount of main pipe (kg) +Additional amount of sub pipe (kg) + Additional amount of branch pipe (kg) = M x ($\ell_o - 2$) + S x {($\ell_1 - 1$) + ($\ell_2 - 1$)} + Na x ($\ell_a - 2$) + Nb x ($\ell_b - 2$) + Nc x ($\ell_c - 2$) + Nd x ($\ell_d - 2$) + Ne x ($\ell_e - 2$) + Nf x ($\ell_f - 2$) + Ng x ($\ell_g - 2$) + Nh x ($\ell_h - 2$)

Table 11-4 Amount of additional refrigerant

Outdoor Unit	Indoor Unit Capacity Ranks (Equivalent Horse Power to Multi Type)	Additional Amount		
		M (kg/m)	S (kg/m)	Na, Nb, Nc, Nd, Ne, Nf, Ng, Nh (kg/m)
MAR-F81HTM8 (Standard amount of refrigerant 17.6 kg)	130 (1.5 HP), 160 (2.0 HP), 200 (2.5 HP)	0.19	0.125	0.030
	260 (3 HP), 360 (4 HP), 460 (5 HP)			0.045
MAR-F101HTM8 (Standard amount of refrigerant 21.6kg)	130 (1.5 HP), 160 (2.0 HP), 200 (2.5 HP)	0.19	0.125	0.030
	260 (3 HP), 360 (4 HP), 460 (5 HP)			0.045

- M = Amount of additional refrigerant for every 1m of actual length of main pipe (The value varies depending on the type of outdoor unit.)
- S = Amount of additional refrigerant for 1 m of actual length of sub pipe.
- Na, Nb, Nc, Nd, Ne, Nf, Ng, Nh = Amount of additional refrigerant for every 1m of actual length of branch pipe. (The value varies depending on the capacity rank of indoor unit.)
- ℓ_o = Actual length of main pipe. (m)
- ℓ_1, ℓ_2 = Actual length of sub pipe (m)
- ℓ_a, ℓ_b , ℓ_c, ℓ_d, ℓ_e, ℓ_f, ℓ_g, ℓ_h = Actual length of branch pipe. (m)

12. DESCRIPTION OF OPERATION

12-1. Simultaneous Cooling/Heating Operation Control Outline

12-1-1. Switching between the Cooling and Heating Operations for Each Indoor Unit

The solenoid valves inside the multi-controller are switched with requested commands sent from the indoor unit.

- SVS valve (at suction gas side) opens for a cooling command.
- SVD valve (at discharge gas side) opens for a heating command.

12-1-2. Determining the Outdoor Unit Operation Mode (Cooling/Heating) and Operation Frequency of the Compressor

The cooling or heating mode of the outdoor unit and the operation frequency of the compressor are determined by difference between all the requested cooling command frequencies and all the requested heating command frequencies of all the indoor units.

12-1-3. Controlling the Refrigerant Cycle in the Outdoor Unit during Simultaneous Cooling-Dominant Operation

(1) Flow control

In order to divide the cooling exhaust heat appropriately to the indoor units in the heating operation and outdoor heat exchanger, the opening of the PMV2 flow control valve is controlled by the difference between all the requested cooling command frequencies and all the requested heating command frequencies and by the operation frequency.

(2) Pressure control

Constant high-pressure control is performed so that the capacity of the indoor units in the heating operation is maintained.

1) Outdoor fan control
2) Switching between the outdoor main heat exchanger and the sub heat exchanger

Since the high pressure may drop even when the fan is shut down by the outdoor fan control if the outside air temperature is low and the difference between the cooling and heating command frequencies is minimal, the main heat exchanger is switched to the sub heat exchanger which is smaller than the ordinary main exchanger.

12-1-4. Controlling the Refrigerant Cycle in the Outdoor Unit during Simultaneous Heating-Dominant Operation

(1) Expansion valve control

Control for preventing superheat is performed by the outdoor heating expansion valve.

(2) Evaporating temperature control

The evaporating temperature control is performed by outdoor fan control so that the capacity of the indoor units in the cooling operation is maintained.

(3) Switching between outdoor expansion valve control and capillary control

When there is a minimal difference between the cooling and heating frequencies and the heat absorption by the outdoor heat exchanger is low, the expansion valve is no longer capable of controlling adequately the flow. This results in capillary control being selected.

12-2. Functions and Operations of Solenoid Valves

12-2-1. Multi-controller

(1) Valve functions

Symbol	Name of Valve	Description of Function
PMV (A, B, C, D)	Flow rate control valve	This opens to the extent corresponding to the capacity and performance required of the indoor units in each system.
SVS (A, B, C, D)	Suction gas valve	Opens when commands from the indoor units in each system call for cooling.
SVD (A, B, C, D)	Discharge gas valve	Opens when commands from the indoor units in each system call for heating.
SVSS	Pressure reducing solenoid valve	Opens when number of units in heating operation is reduced (heating → shutdown or cooling).
		Opens when defrosting starts.
		Opens while oil recovery is controlled in cooling.
SVDD	Pressure increasing solenoid valve	Opens when number of units in heating operation is increased (shutdown or cooling → heating).
		Opens while control is performed to prevent liquid in discharge pipe from being blocked.
SVH	Superheat solenoid valve	Opens when unit in cooling operation is present.

(2) Valve operations

Outdoor Operation Mode	Indoor Operation Mode	SVD	SVS	PMV (Normal)
Shutdown	Shutdown, fan	OFF	OFF	Fully closed
During operation	Shutdown, fan	OFF	ON	Fully closed
	Cooling	OFF	ON	Rated opening
	Cooling thermo-control OFF	OFF	ON	Fully closed
	Heating	ON	OFF	Rated opening
	Heating thermo-control OFF	ON	OFF	Fully closed

12-2-2. Outdoor Unit

(1) Valve functions

Symbol	Name of Valve	Description of Function
20SF	4-way switching valve	Selects whether outdoor main heat exchanger is to be used as condenser or evaporator. OFF: Condenser, ON: Evaporator
		Selects whether outdoor main heat exchanger or sub heat exchanger is to be used. OFF: Main exchanger, ON: Sub exchanger
SV15	Sub heat exchanger solenoid valve	Selects whether the sub heat exchanger is going to be used or not.
		Opens when sub heat exchanger is to be used.
SV13	Cooling solenoid valve	Opens for cooling-only operations.
PMV2	Outdoor flow control valve	Controls flow to divide cooling exhaust heat between indoor units in heating operation and outdoor heat exchanger during simultaneous cooling-dominant operations. • Its opening is increased in accordance with cooling/heating difference. • Its opening is adjusted by the adjustment signal from the multi-controller.
SV14 SV16	Solenoid valve for expansion valve Solenoid valve for capillary	Opens or closes to select the expansion valve or capillary tube according to the difference of cooling/heating during simultaneous operation (cooling/heating) under the heating-dominant operation.
PMV1	Cooling bypass flow control valve	Degree of opening is controlled by discharge and suction temperature.
SV1	High-pressure release solenoid valve	Opens and closes with the heat exchange temperature (TE).
SV2	Hot gas bypass solenoid valve	Opens and closes with the pressure and outside air temperature.
SV4	Solenoid valve for startup compensation	Opens when the compressor (No. 2) at the non-inverter side starts up.
SV5	Gas balance	Opens when the Inverter compressor is shut down.

(2) Valve operations

Outdoor Operation Mode		20SF	SV15	SV13	SV14	SV16	PMV2
Cooling operation	Outdoor main heat exchanger	OFF	OFF	ON	OFF	OFF	–
	Sub heat exchanger	ON	ON	ON	OFF	OFF	–
Heating operation	–	ON	OFF	OFF	ON	OFF	–
Simultaneous cooling-dominant operation	Outdoor main heat exchanger	OFF	OFF	OFF	OFF	OFF	Opening degree control
	Sub heat exchanger	ON	ON	OFF	OFF	OFF	Opening degree control
Simultaneous heating-dominant operation	Expansion valve	ON	OFF	OFF	ON	OFF	–
	Capillary	ON	OFF	OFF	OFF	ON	–

13. OPERATIONS OF EACH SENSOR

13-1. Multi-Controller

Temperature sensor	According to a temperature difference between the evaporator outlet temperature (ThA, B, C, D) and pseudo saturation temperature (Thx) (1) Performs the open compensation of PMV in each system. (Cooling only, and Cooling-dominant operation) (2) Performs the opening degree of the outdoor flow rate control valve. (cooling only, cooling-dominant operation)

13-2. Outdoor Unit

Pressure sensor (High pressure)	Determines the frequency of the compressor Inverter side and ON/OFF status of non-inverter side. (cooling only, heating only, cooling-dominant, heating-dominant operation)
	Controls the outdoor blower. (cooling only, cooling-dominant operation)
	Controls the hot gas bypass SV2. 1) Pd < 13kg/cm^{2}G: Open (cooling) 2) Pd<17kg/cm^{2}G: Open (cooling-dominant sub heat exchanger operation mode)
	Switches the outdoor unit main heat exchanger operation and sub heat exchanger operation
Suction temperature sensor (cooling only, heating only, cooling-dominant operation, heating-dominant operation)	Controls the open degrees of PMV1 (cooling bypass) Operation temperature: 20°C
	Stops when the suction temperature > 40°C continues for ten minutes due to detect the suction temperature abnormality.
Discharge temperature sensor (cooling, heating, cooling-dominant, heating-dominant operation)	Controls open degrees of PMV1 (cooling bypass). Operation temperature: 110°C
	Stops when the discharge temperature >130°C due to detect the count 3 discharge temperature abnormality.
Outdoor unit heat exchanger sensor (heating, heating-dominant operation)	Multiples the time during TE < –3°C and performs the defrost control after 55 minutes. (25 minutes when the power is turned ON for the first time.)
	Controls the outdoor unit blower.
	Controls the high pressure release. Opens when TE > 11°C.
Outdoor temperature sensor	Controls the hot gas bypass SV2. Opens when the outdoor temperature < 0°C (10 HP). Opens when the outdoor temperature < 13°C (8 HP).
	Controls the outdoor blower.
	Identifies whether the forced cooling operation is performed. The forced cooling operation is performed when the outdoor temperature > 25°C.
High pressure switch	Stops when Pd> 30 kg/cm2G in both of inverter side and non-inverter compressor side due to detects the high pressure abnormality.
Low pressure switch Operation pressure: 0.25 kg/cm^{2}G	Stops all the operations 30 seconds after due to detect the gas leak abnormality. (Cooling, cooling-dominant operation)
	Stops all the operation after counting 10 minutes by the timer counter due to detect the gas leak abnormality. (Heating, heating-dominant operation)
	Ignores the low pressure switch operation. (Defrost operation)

14. COOLING/HEATING AUTOMATIC REMOTE CONTROLLER

14-1. Cooling/Heating Automatic Change-Over Operation

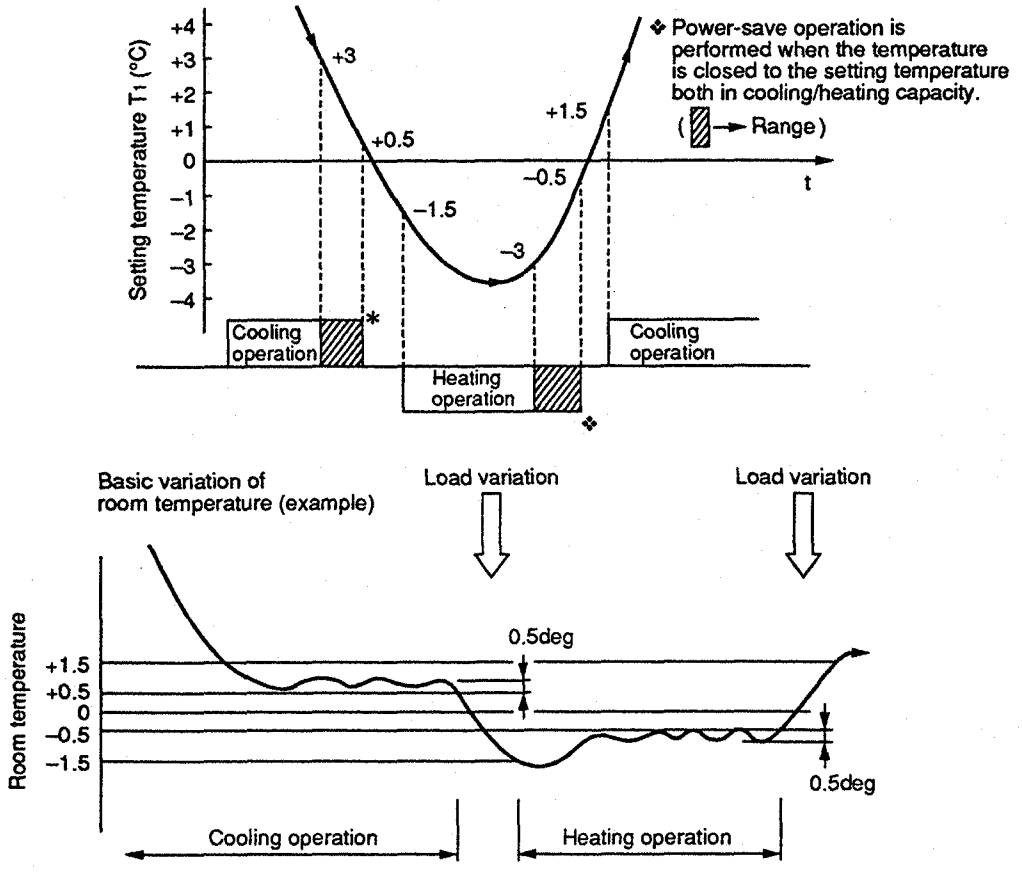


Fig. 14-1

15. IMPORTANT MATTERS TO BE CHECKED BEFORE TEST RUN AND SERVICING

15-1. Registered Indoor Unit Code Numbers

Make sure code numbers of the indoor units connected to the multi-controller are correctly registered in the microprocessor.

Registration of each indoor unit capacity is important. Register the correct indoor unit code numbers corresponding to the capacity rank setting rotary switch on the printed wiring board for Room A (unit A), Room B (unit B), Room C (unit C) and Room D (unit D).

Table 15-1 Code table

Indoor unit	Capacity rank	No connection	130	160	200	260	360	460
	Code number	0	3	4	4	5	8	10

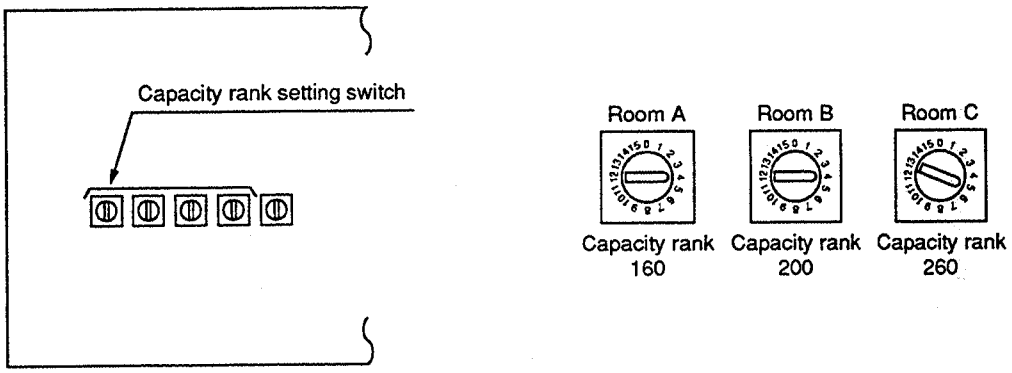


Fig. 15-1

Note:

1. At factory shipment, the indoor capacity rank setting switch is set at "0". With the switch left at the "0" setting, the air conditioner does not operate.
2. If the power is on and even if you operate the capacity selection switch, the registration will not change. Make sure you operate the setting switch before turning on the power, or after operating press the reset switch on the multi-controller for more than three seconds, and then turn off the power to the microprocessor once.
3. If the code number is not registered correctly, the required cooling, heating capacity will not be attained, or this could be the cause of malfunctioning. Also, when the total of the registered indoor unit code numbers exceeds 21 (8 HP outdoor unit) and 27 (10 HP outdoor unit), the air conditioner will not operate.

15-2. Connections of Refrigerant Piping and Control Wires between Indoor Units and Multi-Controller

Check the indications on the label at the refrigerant piping connection ports and control wire connection terminals. The control wires for indoor unit A of which refrigerant pipes are connected to the refrigerant port for unit A should be connected to the terminal for unit A, otherwise the operation won't be carried out properly. Confirm the connection for units B, C and D in the same manner.

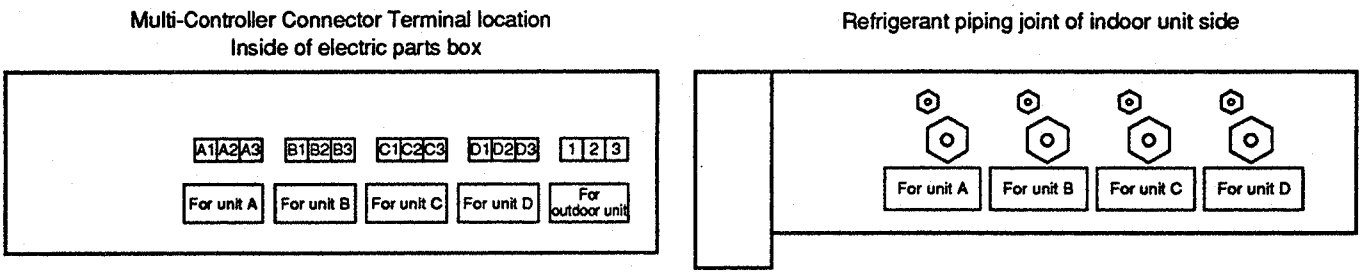


Fig. 15-2

15-3. Connections of Control Wires between Units

Check that the control wires between the indoor units and Multi-controller and between the multi controller and outdoor unit are properly connected. Check to see the terminal numbers for the control wires.

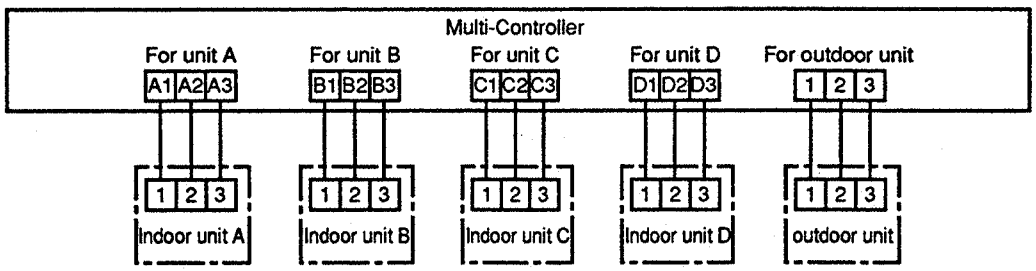
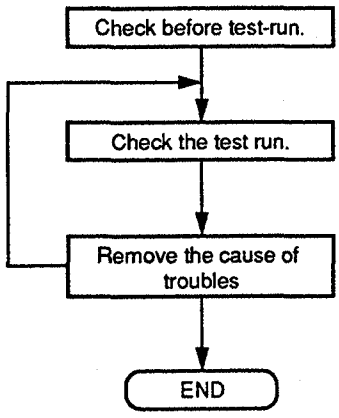


Fig. 15-3

16.TEST RUN

16-1. Test Run Procedure

Conduct the test run as follows. Perform the test run according to each steps on the check list.



Check basic matters of installation works. Ensure to fill up the check-list 1.

Check step by step following the check-list 2, and write down the results.

Remedy malfunctions, following the flow-chart listed on page 44.
Refer to step 3 (Service points), if needed.

Note: Make sure to write the results on check-list #1 and #2. They will be very helpful documents for service and maintenance in the future.

16-2. Check before Test Run

Make sure to confirm there is no fault in the installation works.

Table 16-1 Check list 1

Is the installation work finished correctly?					
1. Is the capacity rank setting switch on multi-controller control board registered correctly to each indoor unit code number?			Indoor unit model name	Registered code number	
	M/C(1)	Unit A			
		Unit B			
		Unit C			
		Unit D			
	M/C (2)	Unit A			
		Unit B			
		Unit C			
		Unit D			
2. Are there wrong connections of the refrigerant pipings and control wirings between indoor units and multi-controller?					
3. Are there wrong connections of both control wirings between indoor unit and Multi-controller, and multi-controller and outdoor unit?					
4. Is the circuit breaker installed?	Breaker capacity		A		

5. Is the breaker capacity adequate?				
6. Is there any wrong wiring of power cable?	Power cable	mm^2		
7. Is the wire size correct?	Control wire	mm^2		
8. Is there a wrong wiring between power source outlet and outdoor unit?				
9. Is the grounding wire attached?				
10. Is there adequate resistance? (more than 10MΩ)	Insulation resistance	MΩ		
11. Is the voltage correct?	Voltage	V		
12. Does the drainage flow smoothly?				
13. Is the heat insulation sufficient? (Especially connecting parts of indoor unit and multi-controller)				
14. Is there a short-circuit of air flow from indoor unit?				
15. Is there a short circuit of blowing air from outdoor unit?				
16. Is the refrigerant added adequately?				
17. Are the valves fully opened?				
18. Is the remote controller normal?				

16-3. Test Run Check

After completion of the check before the test run, conduct the test run check with the following steps listed in the check list 2.

(1) As for the actual procedure of check list 2 (See page 40.), and simultaneously remove the troubles.

(2) More than 12 hours in advance of the test run, turn on the switch for supplying power to the crankcase heater. In the case that the compressor was not warmed up sufficiently by crank case heater, the cooling or heating operation won't work due to protective circuit activated.

(3) The test run check, in principle, should be made for each and every indoor unit. If the multiple units are operating simultaneously, you can not carry on the check for the cross connection between refrigerant piping and control wiring.

(4) To confirm cooling and heating operation, operate the unit under the mode within the possible temperature range to operate the units.

(5) There are few cases when one of two operation modes is normal but the other is not. Make sure to write down the items you have checked.

(6) For this check, you need at least a tester and screw driver (+, –). We recommend you to prepare a thermometer, pressure gauge and other tools (spanners, pliers, nippers, and pins for reset switch.)

Table 16-2 Check list 2

Operation Procedure	Check Items	Confirmation							
		M/C (1)				M/C (2)			
		Unit A	Unit B	Unit C	Unit D	Unit A	Unit B	Unit C	Unit D
1. Turn on the power.	Is the LED on remote controller blinking? Are the conditions initialized for operation?								
2. (Check the Fan operation) Set the operation mode to "Fan", and start operation.	Is the air flow discharging from air-outlet?								
	Is there abnormal noise from fan?								
3. (Check the Cooling operation) Set the operation mode to "Cooling" and start operation. (Once you stopped operation you have to wait for 3 minutes to restart due to the built in restart delay circuit functioning.)	Does the compressor start normally?								
	Is there abnormal noise from the compressor or pipes?								
	Is the cool air flow coming out?								
	Is the air flow circulating adequately?								
	Does the thermostat work normally? (Confirm that compressor stops at high temperature setting, and restarts at low temperature setting.)								
In this case, check every indoor unit operating simultaneously. Set the temperature to the lowest.	Is the temperature difference correct between suction air and exhaust air?								
	Is the voltage of power supply correct? (380 – 415V ± 10%)								
	Is the operating current correct?								
	Is the operating pressure correct?								
4. (Check for the heating operation) Set the operation mode to heating and start the operation. (Once you stopped operation, you have to wait for 3 minutes to restart due to the built-in restart delay circuit functioning.) (Note 1)	Does the compressor start normally?								
	Is there abnormal sound? (Compressor, pipings)								
	Is the warm air flow coming out?								
	Is the air flow circulating adequately?								
	Does the thermostat work normally? (Confirm that compressor stops at low temperature setting, and restarts at high temperature setting.)								

Operation Procedure		Check Items	Confirmation							
			M/C (1)				M/C (2)			
			Unit A	Unit B	Unit C	Unit D	Unit A	Unit B	Unit C	Unit D
	In this case, check every indoor unit operating simultaneously. Set the temperature to the highest.	Is the temperature difference correct between suction air and exhaust air?								
		Is the voltage of power supply correct? (380 – 415V ± 10%)								
		Is the operating current correct?								
		Is the operating pressure correct?								

Note: 1. When the outdoor temperature rises above 21°C, it will be forced into reverse operation to protect the units.

16-4. Guidelines

16-4-1. Guideline for Suction/Discharge Temperature Difference

(1) If the difference between the dry-bulb temperatures at the suction port and discharge port of the air conditioner is 10°C or more when operation has continued for at least 30 minutes in the "COOL" mode, the system is operating properly. (Operation at max. Hz)

(2) If the difference between the dry-bulb temperatures at the suction port and discharge port of the air conditioner is 18°C or more when operation has continued for at least 30 minutes in the "HEAT" mode, the system is operating normally. (Operation at max. Hz)

16-4-2. Guideline for Operating Current

If the current is within ±15% of the value given in the catalog in both the heating and cooling modes, the system is operating normally. (Cooling: operation at max. Hz; heating: operation at max. Hz)
The current varies as follows depending on the operating conditions.

(1) When the current is higher than the standard current
- High indoor/outdoor temperatures
- Poor heat dissipation of outdoor unit (during cooling)

(2) When the current is lower than the standard current
- Low indoor/outdoor temperatures
- Gas leak (insufficient refrigerant)

16-4-3. Guideline for Operating Pressure

(1) The operating pressure level is generally as listed below.

Table 16-3

Cooling	High pressure: 16 to 20 kg/cm^{2}G Low pressure: 3.5 to 5.5 kg/cm^{2}G	Indoor: 18°C to 32°C Outdoor: 25°C to 35°C
Heating	High pressure: 15 to 21 kg/cm^{2}G Low pressure: 3 to 4.5 kg/cm^{2}G	Indoor: 15°C to 25°C Outdoor: 5°C to 10°C

Note: Cooling: Operation at max. Hz, Heating: Operation at max. Hz

The above figures indicate the pressure levels established 15 minutes after operation starts up. (dry-bulb temperature °C)

(2) Changes in high and low pressures caused by changes in operating conditions

1) Cooling:
   - Rise in indoor temperature:Rise in high and low pressures
   - Drop in indoor temperature: Drop in high and low pressures
   - Rise in outdoor air temperature: Rise in high and low pressures
   - Drop in outdoor air temperature: Drop in high and low pressures

2) Heating:
   - Rise in indoor temperature: Rise in high and low pressures
   - Drop in indoor temperature: Drop in high and low pressures
   - Rise in outdoor air temperature: Rise in high and low pressures
   - Drop in outdoor air temperature: Drop in high and low pressures

16-4-4. Flashing of Remote Controller's Operation Lamp

When the power is turned on, the remote controller's operation lamp will flash (ON for 0.5 sec. and OFF for 0.5 sec.). This is not indicative of a failure or malfunction.

16-4-5. PREHEAT/DEFROST Flashing

In the following cases, "PREHEAT/DEFROST" will flash (at 4 second intervals) on the LCD display of the remote controller. This is not indicative of a failure or malfunction.

Case:
1. When the combination of indoor units exceeds the capacity or when the code number entered by the capacity rank setting switch is incorrect (so that capacity is exceeded).
2. When the indoor unit assigned by the command has been excluded by the operating mode selector switch.

17. SERVICING PROCEDURES

The remote controller, multi-controller and outdoor unit are provided with check displays (remote controller) and LED displays (microprocessor control PC board) in order to check the operating conditions,and these displays identify the operating status.

Given below are the methods which use this self-diagnosis function to identify what is malfunctioning or failing in the air conditioner.

(1) Basically, trouble locations are identified by the check displays on the remote controller.

(2) Details of trouble in the multi-controller or outdoor unit are indicated by the check LED displays on the multi-controller or interface control PC board.

(3) Trouble in the multi-controller is also indicated on the interface PC board in the outdoor unit. This means that trouble in the multi-controller can be identified from the outdoor unit as well.

Following Notes are shown in Fig. 17-1.

Note 1: This indicates the codes for the trouble in the indoor unit.

Note 2: This indicates the codes for the trouble in the heat source unit.

Note 3: Code "04" indicates serial signal trouble. There is no code display on the remote controller for over capacity, but the "PREHEAT/DEFROST" display will flash.

Note 4: Code"04" indicates serial signal trouble. "21" is indicated for trouble in the non-inverter compressor or high pressure trouble.
There is no code display on the remote controller for trouble in the power supply phase sequence but the "PREHEAT/DEFROST" display will flash.

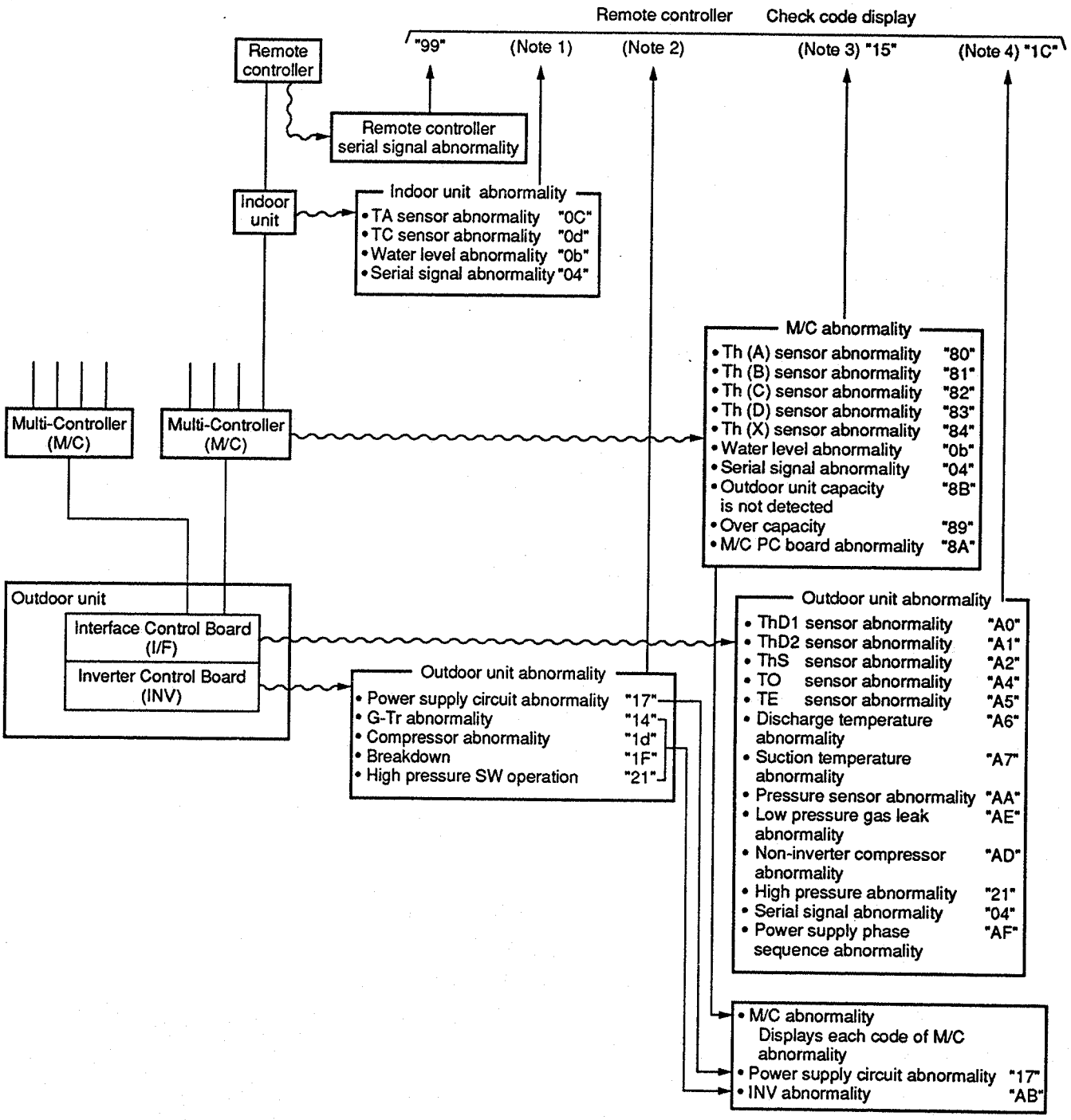
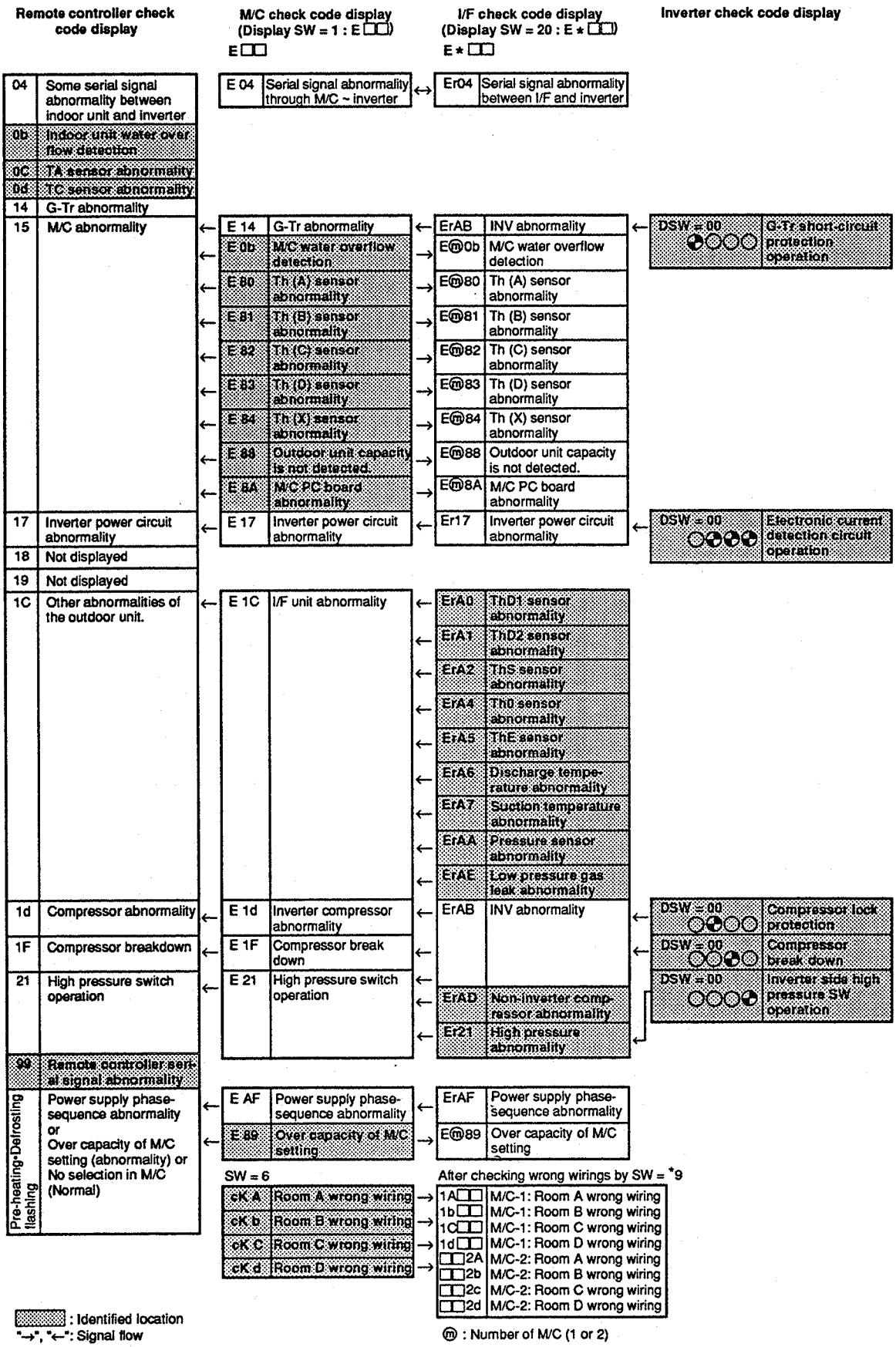

Remote controller
Check code display
"99"
(Note 1)
(Note 2)
(Note 3) "15"
(Note 4) "1C"
Remote controller
Remote controller serial signal abnormality
Indoor unit
Indoor unit abnormality
• TA sensor abnormality "0C"
• TC sensor abnormality "0d"
• Water level abnormality "0b"
• Serial signal abnormality "04"
M/C abnormality
• Th (A) sensor abnormality "80"
• Th (B) sensor abnormality "81"
• Th (C) sensor abnormality "82"
• Th (D) sensor abnormality "83"
• Th (X) sensor abnormality "84"
• Water level abnormality "0b"
• Serial signal abnormality "04"
• Outdoor unit capacity is not detected "8B"
• Over capacity "89"
• M/C PC board abnormality "8A"
Multi-Controller (M/C)
Multi-Controller (M/C)
Outdoor unit
Interface Control Board (I/F)
Inverter Control Board (INV)
Outdoor unit abnormality
• Power supply circuit abnormality "17"
• G-Tr abnormality "14"
• Compressor abnormality "1d"
• Breakdown "1F"
• High pressure SW operation "21"
Outdoor unit abnormality
• ThD1 sensor abnormality "A0"
• ThD2 sensor abnormality "A1"
• ThS sensor abnormality "A2"
• TO sensor abnormality "A4"
• TE sensor abnormality "A5"
• Discharge temperature abnormality "A6"
• Suction temperature abnormality "A7"
• Pressure sensor abnormality "AA"
• Low pressure gas leak abnormality "AE"
• Non-inverter compressor abnormality "AD"
• High pressure abnormality "21"
• Serial signal abnormality "04"
• Power supply phase sequence abnormality "AF"
• M/C abnormality
Displays each code of M/C abnormality
• Power supply circuit abnormality "17"
• INV abnormality "AB"

Fig. 17-1

18. CHECK CODE DISPLAY SYSTEM CHART

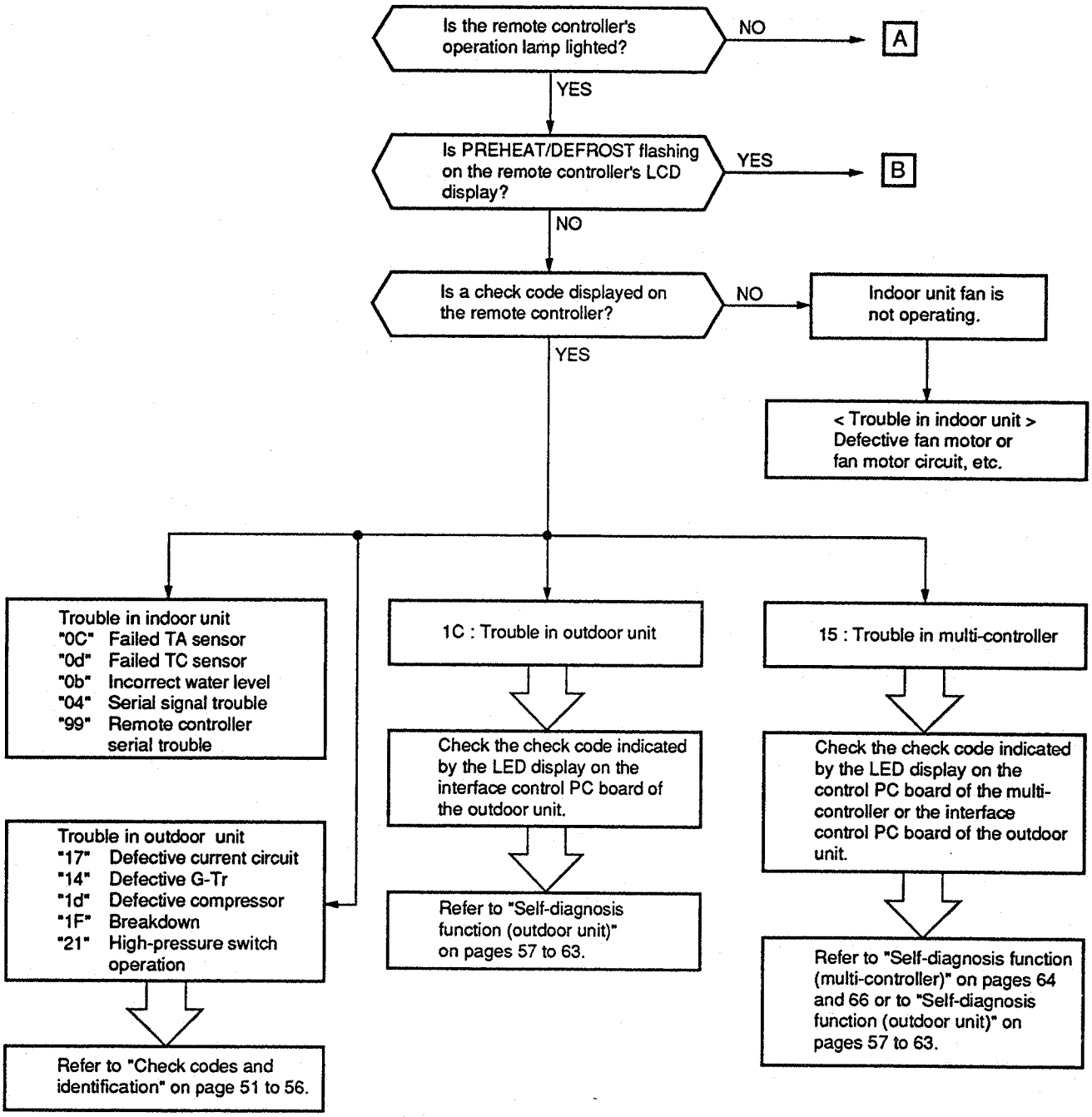

Remote controller check code display
M/C check code display (Display SW = 1 : E□□)
E□□
I/F check code display (Display SW = 20 : E*□□)
E*□□
Inverter check code display
04 Some serial signal abnormality between indoor unit and inverter
E 04 Serial signal abnormality through M/C ~ inverter
Er04 Serial signal abnormality between I/F and inverter
0b Indoor unit water over flow detection
0C TA sensor abnormality
0d TC sensor abnormality
14 G-Tr abnormality
15 M/C abnormality
E 14 G-Tr abnormality
ErAB INV abnormality
DSW = 00 G-Tr short-circuit protection operation
E 0b M/C water overflow detection
Em0b M/C water overflow detection
E 80 Th (A) sensor abnormality
Em80 Th (A) sensor abnormality
E 81 Th (B) sensor abnormality
Em81 Th (B) sensor abnormality
E 82 Th (C) sensor abnormality
Em82 Th (C) sensor abnormality
E 83 Th (D) sensor abnormality
Em83 Th (D) sensor abnormality
E 84 Th (X) sensor abnormality
Em84 Th (X) sensor abnormality
E 88 Outdoor unit capacity is not detected.
Em88 Outdoor unit capacity is not detected.
E 8A M/C PC board abnormality
Em8A M/C PC board abnormality
17 Inverter power circuit abnormality
E 17 Inverter power circuit abnormality
Er17 Inverter power circuit abnormality
DSW = 00 Electronic current detection circuit operation
18 Not displayed
19 Not displayed
1C Other abnormalities of the outdoor unit.
E 1C I/F unit abnormality
ErA0 ThD1 sensor abnormality
ErA1 ThD2 sensor abnormality
ErA2 ThS sensor abnormality
ErA4 Th0 sensor abnormality
ErA5 ThE sensor abnormality
ErA6 Discharge temperature abnormality
ErA7 Suction temperature abnormality
ErAA Pressure sensor abnormality
ErAE Low pressure gas leak abnormality
1d Compressor abnormality
E 1d Inverter compressor abnormality
ErAB INV abnormality
DSW = 00 Compressor lock protection
1F Compressor breakdown
E 1F Compressor break down
DSW = 00 Compressor break down
21 High pressure switch operation
E 21 High pressure switch operation
ErAD Non-inverter compressor abnormality
Er21 High pressure abnormality
DSW = 00 Inverter side high pressure SW operation
99 Remote controller serial signal abnormality
Pre-heating•Defrosting flashing
Power supply phase-sequence abnormality or Over capacity of M/C setting (abnormality) or No selection in M/C (Normal)
E AF Power supply phase-sequence abnormality
ErAF Power supply phase-sequence abnormality
E 89 Over capacity of M/C setting
Em89 Over capacity of M/C setting
SW = 6
After checking wrong wirings by SW = *9
cK A Room A wrong wiring
1A□□ M/C-1: Room A wrong wiring
cK b Room B wrong wiring
1b□□ M/C-1: Room B wrong wiring
cK C Room C wrong wiring
1C□□ M/C-1: Room C wrong wiring
cK d Room D wrong wiring
1d□□ M/C-1: Room D wrong wiring
□□2A M/C-2: Room A wrong wiring
□□2b M/C-2: Room B wrong wiring
□□2c M/C-2: Room C wrong wiring
□□2d M/C-2: Room D wrong wiring
: Identified location
"→", "←": Signal flow
m : Number of M/C (1 or 2)

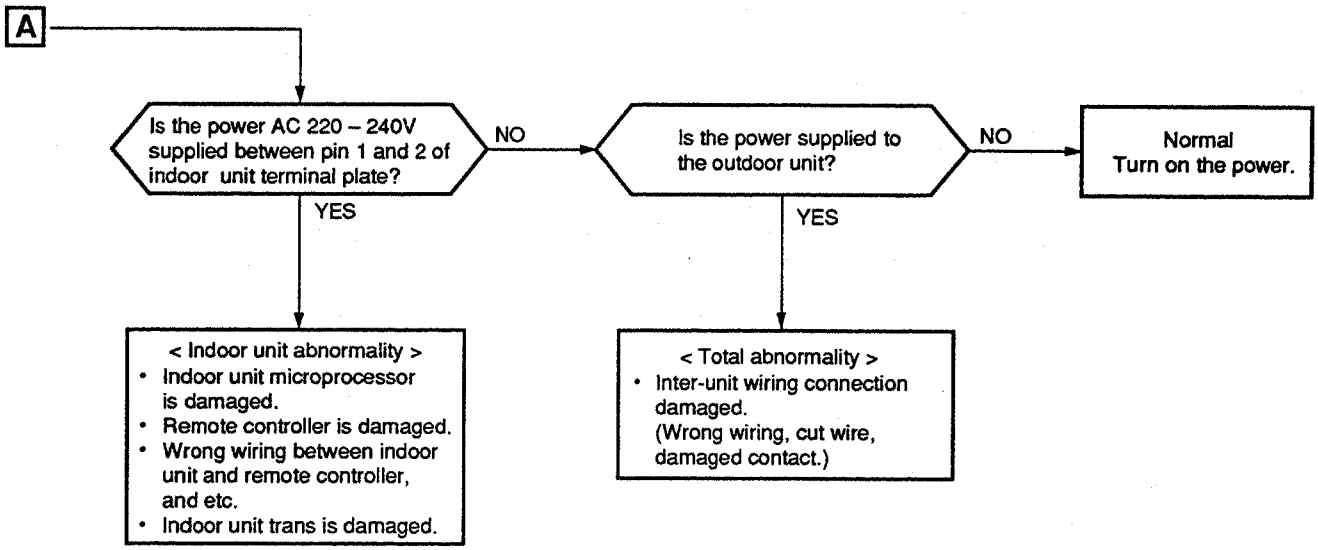
19. IDENTIFICATION PROCEDURES

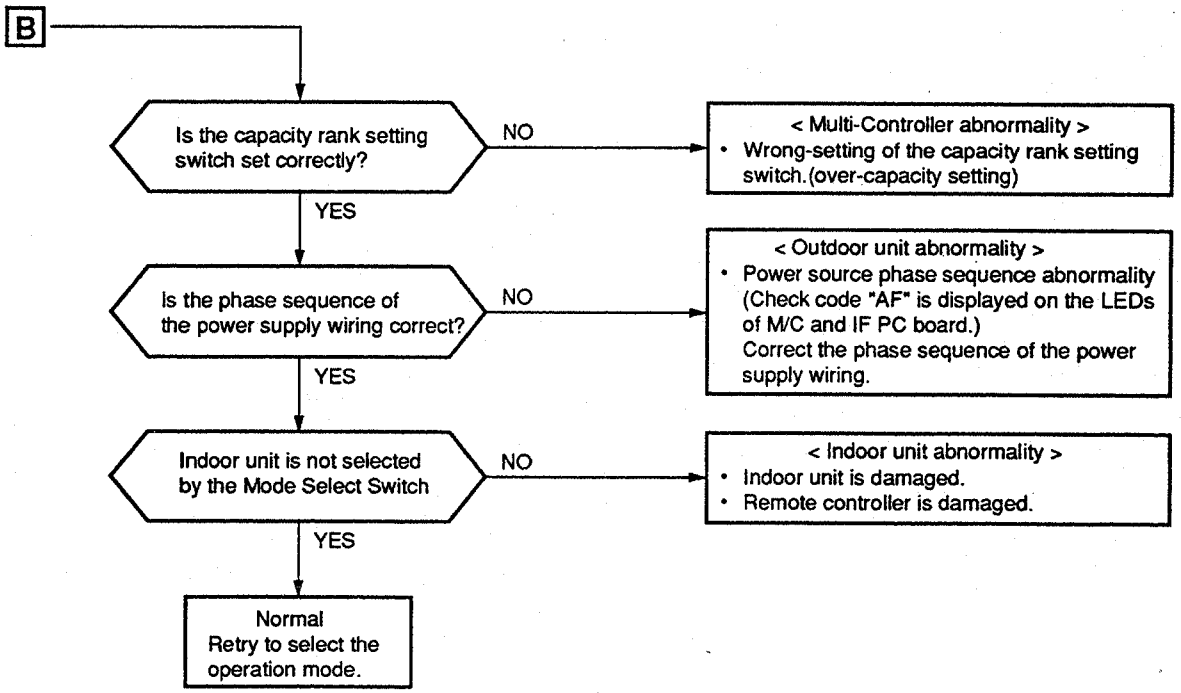
When there is a sign of trouble, do not reset but press the "check switch" on the remote controller and check the check code.
Whether the trouble location is in the indoor unit, multi-controller or outdoor unit can be identified by the check code.

When the failure has been identified to be in the multi-controller or outdoor unit, its cause can be identified by the LEDs on the control PC board inside the electrical parts box of the Multi-controller or outdoor unit. The causes of multi-controller failure can also be identified from the outdoor unit.

(1) Press the check switch on the remote controller and check the check code.
(See pages 49 to 56 for the checking method.)


Is the remote controller's operation lamp lighted?
NO
A
YES
Is PREHEAT/DEFROST flashing on the remote controller's LCD display?
YES
B
NO
Is a check code displayed on the remote controller?
NO
Indoor unit fan is not operating.
YES
< Trouble in indoor unit >
Defective fan motor or fan motor circuit, etc.
Trouble in indoor unit
"0C" Failed TA sensor
"0d" Failed TC sensor
"0b" Incorrect water level
"04" Serial signal trouble
"99" Remote controller serial trouble
1C : Trouble in outdoor unit
15 : Trouble in multi-controller
Check the check code indicated by the LED display on the interface control PC board of the outdoor unit.
Check the check code indicated by the LED display on the control PC board of the multi-controller or the interface control PC board of the outdoor unit.
Trouble in outdoor unit
"17" Defective current circuit
"14" Defective G-Tr
"1d" Defective compressor
"1F" Breakdown
"21" High-pressure switch operation
Refer to "Self-diagnosis function (outdoor unit)" on pages 57 to 63.
Refer to "Self-diagnosis function (multi-controller)" on pages 64 and 66 or to "Self-diagnosis function (outdoor unit)" on pages 57 to 63.
Refer to "Check codes and identification" on page 51 to 56.


A
Is the power AC 220 – 240V supplied between pin 1 and 2 of indoor unit terminal plate?
NO
Is the power supplied to the outdoor unit?
NO
Normal
Turn on the power.
YES
YES
< Indoor unit abnormality >
• Indoor unit microprocessor is damaged.
• Remote controller is damaged.
• Wrong wiring between indoor unit and remote controller, and etc.
• Indoor unit trans is damaged.
< Total abnormality >
• Inter-unit wiring connection damaged.
(Wrong wiring, cut wire, damaged contact.)


B
Is the capacity rank setting switch set correctly?
NO
< Multi-Controller abnormality >
• Wrong-setting of the capacity rank setting switch.(over-capacity setting)
YES
Is the phase sequence of the power supply wiring correct?
NO
< Outdoor unit abnormality >
• Power source phase sequence abnormality
(Check code "AF" is displayed on the LEDs of M/C and IF PC board.)
Correct the phase sequence of the power supply wiring.
YES
Indoor unit is not selected by the Mode Select Switch
NO
< Indoor unit abnormality >
• Indoor unit is damaged.
• Remote controller is damaged.
YES
Normal
Retry to select the operation mode.

20.JUDGMENT OF MALFUNCTIONS WITH THE REMOTE CONTROLLER INDICATION

20-1. Malfunction Check Display Operation

Check: Pressing the check switch on, the compressor's ON/OFF times and the check code are shown on the time part in display.

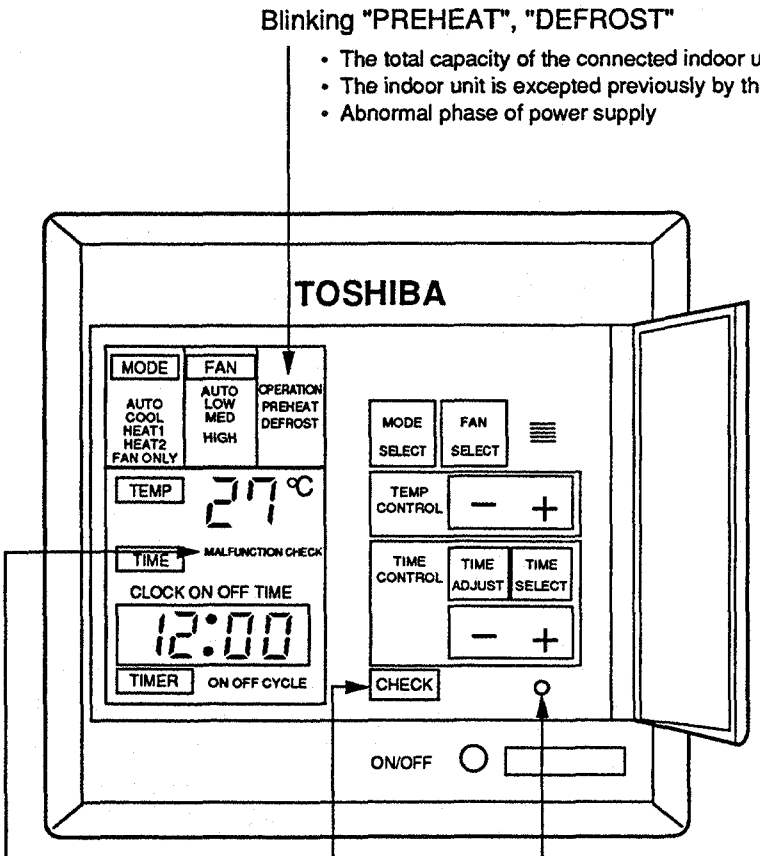
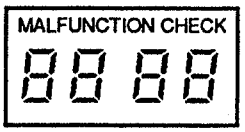


Fig. 20-1

20-2. How to Read the Malfunction Check Monitor Display

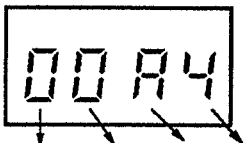
By pressing CHECK key, times of No. 1 unit compressor-ON actuations as well as the check code information of 2 faults x 16 units are displayed on the time display area. (2 sec. per one phenomenon).

Times of compressor - ON



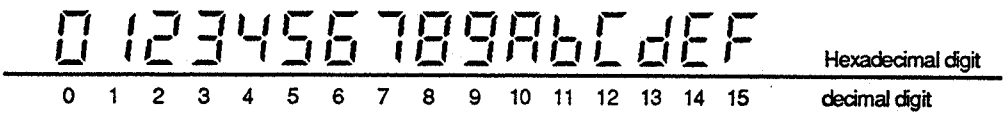
Display in 4 digits of hexadecimal notation.

Example 1
In case of the number of times of compressor actuations of 164.

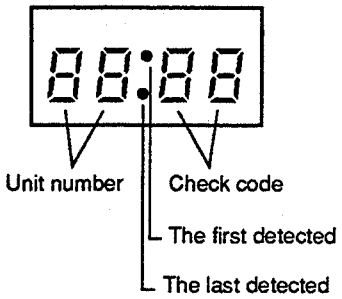


$16^3 \times 0 + 16^2 \times 0 + 16 \times 10 + 4 = 164$

Display in 7 segments

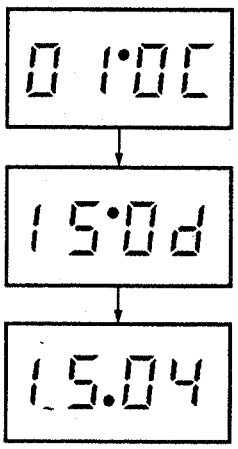


Check code information



Example 2:
In case of room temperature sensor of No. 1 unit in trouble.

Example 3:
For No. 15 unit, firstly room temperture sensor and secondly connecting cable between the indoor and outdoor units (serial signal) are in trouble.



No display is made if there is no fault.

Fig. 20-2

20-3. The Check Code and the Judgment

Table 20-1-A

Check code	Method of Judgment	Which Parts	How about the Conditions
04	• Judgment is performed on the stop of the serial signal from outdoor unit. (Operation continuing)	• Inter-wire for indoor/outdoor units. • TRS thermal switch . • Crank case heater. • Compressor case thermostat.	• Can't discriminate the signal due to a stop or wrong signal. • The serial signal has stopped because the case thermostat circuit was opened due to low temperature in the compressor case.
06	• Judgment is performed on the presence of 220 – 240V for the indoor unit's board connector PJ11 by using the photo coupler (IC06). • Float switch movement (Operation continuing) (Outdoor unit stops fully.)	• Drainage system. • Drain pipe is stuffed. • Drain pump. • Control system. • PJ11 connector. • Photo coupler.	• Float switch movement. • Due to a bad connector contact, the photo coupler on the PC board becomes faulty, and the like.
0C	• Judgment is performed on the room temperature sensor. • The resistance value is infinite or zero. (Operation continuing)	• Room temperature sensor (TA).	• Lead wire cut. • Loose connector due to a bad contact. • Wire cut in the sensor. • Short circuit caused by the insertion of the lead wire. • Short circuit in the sensor.
0d	• Judgment is performed on the indoor heat exchanger sensor (TC). • The resistance value is infinite or zero (Operation continuing).	• Heat exchanger sensor (TC).	• Lead wire cut. • Bad connector contact due to loose insertion. • Wire cut in the sensor. • Short circuit due to the insertion of lead wire. • Short circuit in the sensor.

Table 20-1-A'

How about the Operation	Method of Diagnosis	Notes
• Although the fan is carrying on the operation, cooling or heating operation does not work because outdoor unit stops. (In normal operation, the LED for the serial signal will blink.)	• Check up the inter-wire for wrong wiring, disconnection, or bad contact. • Check the current at TRS thermostat. • In case that terminal voltage is applied at the crank case heater connector, check for crank case heater. • In the case of no terminal voltage at the crank case heater, check for compressor case thermostat.	• For inverter type, when aluminum radiation temperature goes over the setting value, the serial signal circuit will be open. • By making the serial signal circuit of the multi-controller, etc., an open circuit, the type that forms a protective circuit.
• Indoor unit is operating, but outdoor unit stops.	• Drainage pipe repair. • Drain pump repair. • Check the connector contact points. • Check on the PC board.	• There is no 220 – 240V for PJ11 connector. • Due to the common use of the PC board for various models, this code may appear if the model without drain pump is connected.
• Cooling operation carries on with thermostat at off position. • Heating operation carries on with thermostat at on position.	• Check the resistance value of TA sensor. • If there are any peculiar defects, replace.	
• For cooling operation, freeze prevention control does not work. • For heating operation, outdoor unit carries on its work intermittently under the high temperature release control. • For cooling operation, freeze prevention control does not work. • For heating operation, outdoor unit carries on its work intermittently under the high temperature release control.	• Check the resistance value on the TC sensor. • If there are any peculiar defects, replace.	

Table 20-1-B

Check code	Method of Judgment	Which Parts	How about the Conditions
14	• Judgment is performed on the over-current protection circuit or the insufficient voltage protection circuit. (Short time) Full stop.	• Power supply. • Wiring. • Fuses. • Giant transistor. • Base drive board. • Smoothing capacitor. • Rectifier. • Diode. • Compressor.	• Under voltage protection circuit functioning, due to a voltage reduction. • Over-current protection circuit functioning.
17	• Judgment is performed on the temperature sensor (ThA, B, C, D). • The resistance value is infinite or zero. Full stop.	• Temperature sensor (ThA, B, C, D).	• Operation stops due to a malfunction in the multi-controller.
15	• At the stop of compressor, operation judgment is performed when the current comes into the current sensor circuit. Full stop.	• Assembly of PC board.	• Due to an abnormality detected in the current, operation stops.
1C	• Judgment is performed on the (LED 50) red light on the outdoor inverter control board. (MCC-1521). Full stop. • Judgment on the abnormality of interface board. Full stop.	• 14. • 1d. • 21 items. • ThD1, ThD2. Ths sensor. • Pressure sensor. • Low pressure switch.	• Under voltage protection circuit functioning, due to voltage reduction. • Over-current protection circuit functioning. • High pressure switch functioning. • Lead wire cut. • Bad connector contact. • Pressure abnormal. • Loose or cut in sensor connectors. • Discharge air temperature abnormal.
1d	• Judgment is performed on the over-current protection circuit or the insufficient voltage protection circuit. (Short time) Full stop.	• Power supply. • Wiring. • Crank case heater. • Compressor.	• Under voltage protection circuit functioning, due to voltage reduction. • Over-current protection circuit functioning.

Table 20-1-B'

How about the Operation	Method of Diagnosis	Notes
• Operation stops due to inverter tripping. • Restart does not work.	• Check the power supply. • Repair the disconnection, loose contact or cut of wires, fuses or reactors. • Replace the defective parts. • Check the giant transistor, base drive, smoothing capacitor, rectification diode, compressor and other connections.	
• Operation stops. • Restart does not work.	• Check the operation of the PC board.	
• Operation stops • Restart does not work.	• Check the contact condition of multi-controller temperature sensor connector and its specifications.	• Multi-controller type.
• Operation stops. • Restart does not work.	• Check 14. • Check 1d. • Check 21 items. • Check every sensor resistance. If there are faults of specifications, replace. • Capillary tube is stuffed up. • Check sensor resistance.	
• Operation stops. • Restart does not work.	• Check the power supply • Repair the disconnection, loose contacts and cut in wiring and power relay.	

Table 20-1-C

Check code	Method of Judgment	Which Parts	How about the Conditions
1F	• Judgment is performed when the larger AC current than the rated one continuously comes into the c urrent sensor circuit. Full stop.	• Power supply. • Wiring. • Crank case heater. • Compressor.	• Under voltage protection circuit functioning, because of voltage reduction. • Over-current protection circuit functioning. • Malfunctioning of current detection circuit.
21	• Judgment is performed on the continuous time for the high pressure switch functioning. Full stop.	• Operating condition. • High pressure switch. • Inner over-load relay. • Indoor fan motor capacitors. • TC, TL sensor PC board assembly.	• High pressure switch functioning by overload operation.
99	• Wrong wiring between the remote control and the indoor units, or a selection mistake. (Stop of operation)	• Inter-wiring between remote controller a nd indoor units. • Unit No. setting.	• Can't discriminate the signal due to a stop or wrong signal.

Table 20-1-C'

How about the Operation	Method of Diagnosis	Notes
• Operation stops. • Restart does not work.	• Check power circuit. • Check the causes of abnormal loading. • Check PC board works.	
• Operation stops. • Restart does not work.	• Check the causes of abnormal loading. If there are peculiar defects, replace. • Check the TC, TL sensor resistance. • Check PC board works in.	• Both indoor and outdoor units.
• For wrong wiring,operation does not start. • For wrong setting, operation starts depending on the case.	• Cut, bad connection of inter-wiring. • Double setting of indoor unit No. 1.	• Terminal A, B, C.

20-4. Malfunction Judgment with the Self-Diagnostic Function of the Outdoor Unit

The combination of two display selector switches (SW1, SW2) and the LED (LD1 – LD8) indicate the contents below.

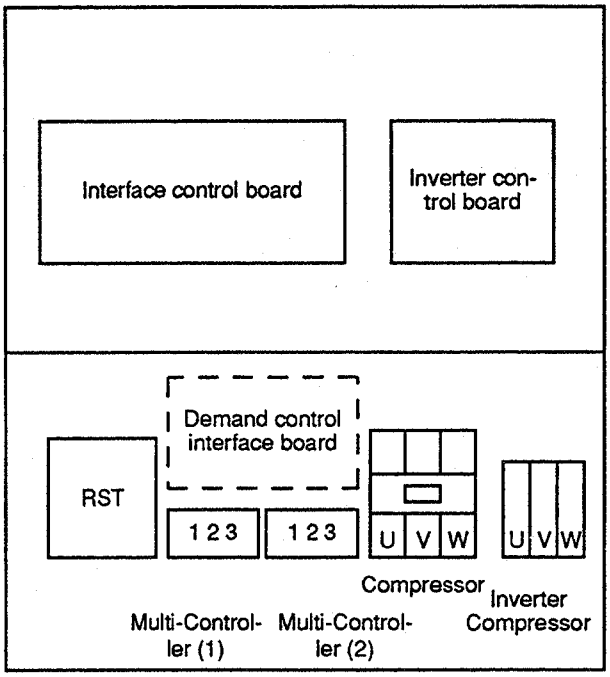


Fig. 20-3 Electric parts location

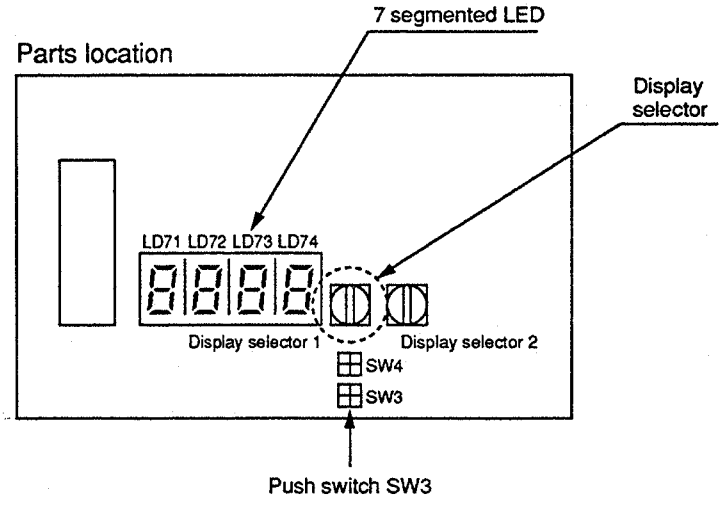


Fig. 20-4 Interface control board

20-4-1. If the Selector Switch SW1 on Outdoor Unit Interface Board is Set at "0"

Sending/receiving serial signals and operating status are displayed. Following contents are indicated by switching the display selector SW2.

Table 20-2

Display selector SW 2	Indication		7 Segmented LED Display			
			LD71	LD72	LD73	LD74
0	Sending/receiving status of serial signal		Between M/C (1)	Between M/C (2)	Between INV	Non-inverter compressor
			Sending only [S]	No sending/receiving [–]		Abnormal [E]
			Receiving only [J]	Sending and receiving [O]		Normal [O]
1	Operating instruction from M/C (1)	Operating mode	Heating [H], Simultaneous cooling/heating [HC], Cooling [C], Stop [–]		———	———
2		Instruction frequency	Heating frequency [00 –1F] (See table 20-3.)		Cooling frequency [00 – 1F] (See table 20-3.)	
3	Outdoor unit operating condition	Operating mode	Heating [H], Cooling [OC], Simultaneous heating [Hc], Defrost [Jo], Simultaneous cooling [hC]		———	———
4			M/C operation No: [0] 1 unit: [1] 2 unit : [2]	Frequency release No: [0] Yes: [1]	———	———
5	Operating instruction from M/C (2)	Operating mode	Heating [H], Simultaneous cooling/heating [HC], Cooling [C], Stop [–]		———	———
6		Instruction frequency	Heating frequency [00 –1F] (See table 20-3.)		Cooling frequency [00 –1F] (See table 20-3.)	
9	Inverter operation status		Normal [C]	Operating frequency [0 – F] (See table 20-4.)	———	———
			Abnormal [E]			
10	Operating instruction to inverter		Normal [C]	Instruction frequency [0 – F] (See table 20-4.)	———	———
			Abnormal [E]		———	———
11	Power supply frequency		50Hz [5]	[0]	———	———
			60Hz [6]			

Table 20-3 Display code conversion table

Display code	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Frequency conversion value (Hz)	0	0	0	3.9	6.9	10.0	13.0	16.2	19.3	22.4	25.5	28.6	31.7	34.8	37.9	41.0
Display code	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
Frequency conversion value (Hz)	44.1	47.2	50.3	53.4	56.5	59.6	62.7	65.8	68.9	72.0	75.1	78.2	81.3	84.4	87.5	90.0

Table 20-4 Display code conversion table

Display code	0	3	4	5	6	7	8	9	A	B	C	D	E	F
Frequency conversion value (Hz)	0	30.5	38.1	42.0	45.8	53.4	61.0	68.7	76.3	83.9	91.6	103.0	110.6	121.6

20-4-2. If the Selector Switch SW1 on Outdoor Unit Interface Board is Set at "2"

Malfunction information is displayed when display selector switch SW2 is set at "0". See the check code.

Table 20-5

Display selector SW 2	Indication	7 segmented LED display			
		LD71	LD72	LD73	LD74
0	Check code display Outdoor unit M/C (1), M/C (2)	[E]	Outdoor unit [r] M/C (1) [1] M/C (2) [2]	Check code: For the contents, see table 20-6.	

20-4-3. The Check Code Judged by Outdoor Unit and Multi-Controller

Table 20-6

Check code		Judgment	
Outdoor unit			
	ErA0	ThD1 sensor abnormality	Defects of sensor, wire cut, short circuit, connectors off
	ErA1	ThD2 sensor abnormality	
	ErA2	ThS sensor abnormality	
	ErA4	TO sensor abnormality	
	ErA5	TE sensor abnormality	

Check code	Judgment
ErA6	Discharge air temperature abnormality (detected by ThD1 and ThD2 sensor) Refrigerant under-charge, gas leakage, over-loading operating condition • PMV1 malfunction (Defect of valve body, defects of coils, connectors off, wire cut.) • PMV1 stuffed up (In cooling, simultaneous cooling operation) • SV13 malfunction • PMV2 malfunction (Defect of valve body, defects of coils, connectors off, wire cut, PC board defects) • PMV (A – D) in M/C malfunction • SVS (A – D) in M/C malfunction • Defect of expansion valve, expansion valve stuffed up (In heating, simultaneous heating operation) • 4-way valve malfunction • SV14 malfunction (Defect of valve body, defects of coils, connectors off, wire cut, PC boards' defects) • SV16 malfunction • PMV (A – D) in M/C malfunction • Defect of expansion valve, expansion valve stuffed up
ErA7	Suction temperature abnormality (detected by ThS sensor) Refrigerant under-charge, gas leakage, over-loading operating condition
ErAA	Pressure sensor abnormality Defects of pressure sensor, wire cut, connectors off, pressure intake capillary tube stuffed up
ErAE	Low pressure gas leakage abnormal (Low pressure switch functioning) Gas leakage, refrigerant under-change (In cooling, simultaneous cooling operation) • PMV(A – D) in M/C malfunction (Defect of valve body, defects of coils, connectors off, wire cut, PC board defects.) • SVS (A – D) in M/C malfunction • Defect of expansion valve, expansion valve stuffed up (In heating, simultaneous heating operation) 4-way valve malfunction • SV14 malfunction (Defect of valve body, defects of coils, connectors off, wire cut, PC board defects) • SV16 malfunction
ErAD	Compressor abnormality (High pressure switch ($63H_2$), Inner over-load relay ($49C_2$), Over-load relay ($51C_2$) in non-inverter compressor side functioning) (1) High pressure switch ($63H_2$) malfunction • Over-loading operating condition • Indoor and outdoor fan motors malfunction (Defects of fan motors and capacitors, wire cut, connectors off, PC boards' defects) • SV13 malfunction (cooling) • PMV2 malfunction (simultaneous cooling) (Defects of valve body, defects of coils, connectors off, PC boards' defects) • SVD (A – D) in M/C malfunction (heating, simultaneous heating) • PMV (A – D) in M/C malfunction

Check code	Judgment
ErAD	(2) Inner over-load relay ($49C_2$) malfunction • Gas leakage, refrigerant under-charge, over-loading operating condition (3) Over-load relay ($51C_2$) malfunction • Over-loading operating condition, compressor liquid accumulation, compressor locked up, mis-phase, crank case heater defects (wire cut, connectors off)
Er21	High pressure abnormality (High pressure switch ($63H_2$), Inner over-load relay ($49C_1$), malfunction, detected by pressure sensor) • High pressure switch ($63H_1$ malfunction) Judgment of ErAD (1). Same judgment as high pressure switch functioning. • Inner over-load relay ($49C_1$) functioning Gas leakage, refrigerant under charge, over-loading operating condition
Er04	Serial signal abnormality (between outdoor unit interface control board and inverter control board.) Connectors off, wire cut, wrong wiring, bad contacts
ErAF	Out of phase in power supply Phase mis-matching of power cable
Er17	Inverter (INV) current circuit abnormality Inverter PC board malfunction
ErAB	Inverter (INV) abnormality (1) Giant transistor abnormality (displays check code "14" on remote controller) • Short voltage protection circuit functioning due to voltage reduction. Check the power supply, wiring, fuses, reactors off, loose or cut. • Check the over-current protection circuit. Defects of giant transistor base drive, smoothing capacitors, current regulation diodes, inverter compressor grounding. (2) Inverter compressor abnormality (displays check code "1d" on remote controller) • Short voltage protection circuit functioning due to voltage reduction Check the power supply, power relay off, loose or cut • Over-current protection circuit functioning. Compressor liquid accumulation, compressor locked up, mis-phase, crank case heater defects (wire cut, connectors off) (3) Break-down of inverter compressor (displays check code "1F" on remote controller) • Current increasing by voltage reduction (Check the power supply.) • Current increasing by over-loading operation • Wrong operation by malfunction of current detection circuit on inverter PC board. (4) High pressure abnormality (High pressure switch ($63H_1$), Inner over-load relay ($49C_1$) malfunction.) • High pressure switch ($63H_1$) malfunction Judgment of ErAd (1). Same judgment as high pressure switch functioning. • Inner over-load relay ($49C_1$) functioning Gas leakage, refrigerant under-charge, over-loading operating condition.

Check code		Judgment	
Multi-controller			
	E180 E280	Th (A) sensor abnormality	Defects of sensors, wire cut, short circuit, connectors off
	E181 E281	Th (B) sensor abnormality	
	E182 E282	Th (C) sensor abnormality	
	E183 E283	Th (D) sensor abnormality	
	E184 E284	Th (X) sensor abnormality	
	E10b E20b	Water level abnormality (Float switch functioning) Drain heater defects (wire cut, connectors off) Float switch defects (wire cut, connectors off)	
	E188 E288	Impossible discrimination of outdoor unit capacities (Displayed when the outdoor unit capacity was unknown.) • Defects of multi-controller control board • Defects of interface board of outdoor unit • Wrong wiring, wire cut or bad connection between multi-controller and outdoor units	
	E189 E289	Over-capacity • Displayed when total capacity of each indoor unit exceeds 1.35 times of outdoor unit capacity	
	E18A E28A	M/C board abnormality • Displayed when the multi-controller control board does not work normally.	

20-4-4. If the Selector Switch SW1 on Outdoor Unit Interface Board is Set at "3"

Capacity rank setting is displayed. Following contents are indicated by switching the display selector SW2.

Table 20-7

Display Selector SW2	Indication		7 Segmented LED Display					
			LD71	LD72			LD73	LD74
0	Outdoor unit horse power		[9]	8 HP [8], 10 HP [A]			[H]	[P]
1	Capacity rank of indoor unit connected to M/C (1)	Room A	[A]	Displays the code number of indoor unit registered to M/C				
2		Room B	[b]					
3		Room C	[c]	Code No.	Capacity rank	Code No.	Capacity rank	
4		Room D	[d]	0	No connection	6	–	
5	Capacity rank of indoor unit connected to M/C (2)	Room A	[A]	2	–	7	–	
6		Room B	[b]	3	130	8	380	
7		Room C	[c]	4	160,200	9	–	
8		Room D	[d]	5	260	10	460	

20-4-5. If the Selector Switch SW1 on Outdoor Unit Interface Board is Set at "4"

Sensor data is displayed. By switching the SW2, the contents are shown in table 20-8.

Table 20-8

Display Selector SW2	Indication	7 Segmented LED Display			
		LD71	LD72	LD73	LD74
0	Pressure sensor data	[P]	[d]		
1	ThD1 sensor data	[d]	[1]	Data [00 – F0] See the conversion table (Table 20-14, 20-15 and 20-16) on pages 59.	
2	ThD2 sensor data	[d]	[2]		
3	ThS sensor data	[S]	[1]		
4	TE sensor data	[h]	[E]		
5	TO sensor data	[h]	[O]		

20-4-6. If the Selector Switch SW1 on Outdoor Unit Interface Board is Set at "1"

PMV opening information is displayed. Following contents are indicated by switching the display selector SW2.

Table 20-9

Display Selector SW2	Indication	7 Segmented LED Display			
		LD71	LD72	LD73	LD74
2	PMV1 opening	[P]	[1]	Data [00 – F0] See the conversion table (Table 20-12) on pages 67 and 68. Completely close [00] Fully open [F0]	
3	PMV2 opening	[P]	[2]		

20-5. Malfunction Judgment with the Self-Diagnostic Function of the Multi-Controller

The combination of the display switches (SW) and four segments LED (LD101 – LD104) indicate the contents below.

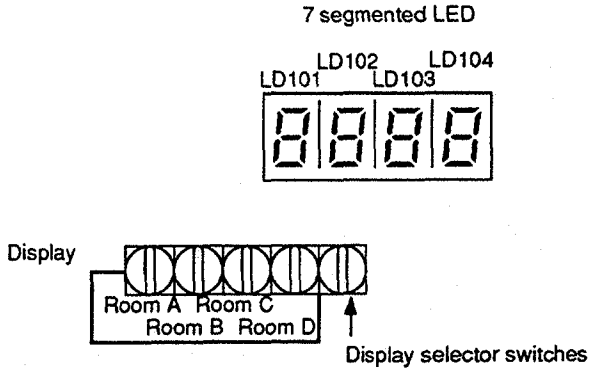


Fig. 20-5 Control board

Table 20-10-A

Switch	Indication	7 Segmented LED Display								
		LD101	LD102	LD103						
				8	8	8	8	8	8	8
0	Serial signal condition	—	—	—	Receiving from room B	Sending to room B	—	Sending to room A	Receiving from room A	Receiving from outdoors
1	Check code	[E]	—	Check code (Normal [00]) ····· For the contents of check code, see page 62.						
2	Frequency instructions to the outdoor unit.	Frequency instruction of heating [00 – 1f] See table 20-3 "Display code conversion table" on page 59.								
3	Oil retrieval Superheat control	—	—	—	Room B When oil retrieval	Room B When controlling superheat	—	Room A When controlling superheat	Room A When oil retrieval	—
	Defrosting display			Displays defrost [dF] functioning						
4	Operation mode	M/C operating mode: Heating [H-] Cooling: [C-] ★		Outdoor unit operating mode: Heating [H-], Cooling [-C] Simultaneous Heating [Hc] Simultaneous Cooling [hC], Stop [--], Defrost [J-]						
5	Re-start timer	—	—	—						
6	Wrong wiring	[c]	[k]	Indicates the indoor units (A, b, C, d) to be checked.						
7	PMV(A) opening	[P]	[A]	Data: [00 – F0] Opening Display in hexadecimal						
8	PMV(B) opening	[P]	[b]							
9	PMV(C) opening	[P]	[c]							
10	PMV(D) opening	[P]	[d]							
11	ThA sensor data	[h]	[A]	Data: See table 20-13 "ThA, B, C, D and X sensor data" on page 69.						
12	ThB sensor data	[h]	[b]							
13	ThC sensor data	[h]	[c]							
14	ThD sensor data	[h]	[d]							
15	ThX sensor data	[h]	[H]							

★ and Simultaneous Cooling/Heating [HC], Defrost [J-]

Note:
For 7 segmented display, the way to read the indication differs depending on the settings of display.

Table 20-11

Display Selector Switch Setting	Method to Read	How to Indicate														
0, 3 ★1	Indicates at the part lighting among seven filaments	8	8	8	8	8	8	8								
		A	B	C	D	E	F	G								
Other than above	Indication marks	0	1	2	3	4	5	6	7	8	9	A	b	C	d	E	F
		0	1	2	3	4	5	6-	7	8	9	A	b	C	d	E	F

Note: ★1
If the display selector switch is set to "3", only the mark of defrost "dF" will be displayed.

Table 20-10-A'

Switch	Indication	7 Segmented LED Display						
		LD104						
0	Serial signal condition	—	Receiving from room D	Sending to room D	—	Sending to room C	Receiving from room C	Sending to outdoors
1	Check code	Check code (Normal [00]) ····· For the contents of check code, see page 51 ~ 55.						
2	Frequency instructions to the outdoor unit.	Frequency instruction of cooling [00 – 1F] See table 20-3 "Code conversion table" on page 59.						
3	Oil retrieval Superheat control	—	Room D When oil retrieval	Room D When controlling superheat	—	Room C When controlling superheat	Room C On oil retrieval	—
	Defrosting display	Displays defrost [dF] functioning						
4	Operation mode	Outdoor unit operating mode: Heating [H-], Cooling [-C] Simultaneous Heating [Hc] Simultaneous Cooling [hC], Stop [–], Defrost [J-]						
5	Re-start timer	Normal [0], Restart timer counting [1]						
6	Wrong wiring	Displays a part of wrong wiring [A, b, C, d] [A] Wrong wiring in room A [b] Wrong wiring in room B [C] Wrong wiring in room C [d] Wrong wiring in room D						
7	PMV(A) opening	Data: [00 – F0] Opening Display in hexadecimal						
8	PMV(B) opening							
9	PMV(C) opening							
10	PMV(D) opening							
11	ThA sensor data	Data: See table 20-13 "ThA, B, C, D and X sensor data" on page 69.						
12	ThB sensor data							
13	ThC sensor data							
14	ThD sensor data							
15	ThX sensor data							

20-6. PMV Opening Degree, Temperature Sensor and Pressure Sensor Data Code Display Conversion Table

20-6-1. PMV (Electronic Flow Control Valve) Opening Degree Data

PMV (A), (B), (C), (D) ..... Multi-controller
PMV1, 2 ..... Outdoor unit
PMV opening degree ..... 0 to 240 pulses
00 (0) ..... Fully closed
F0 (240) ..... Fully open

Table 20-12

Display	Opening degree (pulse)
00	0
01	1
02	2
03	3
04	4
05	5
06	6
07	7
08	8
09	9
0A	10
0B	11
0C	12
0D	13
0E	14
0F	15
10	16
11	17
12	18
13	19
14	20
15	21
16	22
17	23
18	24
19	25

Display	Opening degree (pulse)
1A	26
1B	27
1C	28
1D	29
1E	30
1F	31
20	32
21	33
22	34
23	35
24	36
25	37
26	38
27	39
28	40
29	41
2A	42
2B	43
2C	44
2D	45
2E	46
2F	47
30	48
31	49
32	50
33	51

Display	Opening degree (pulse)
34	52
35	53
36	54
37	55
38	56
39	57
3A	58
3B	59
3C	60
3D	61
3E	62
3F	63
40	64
41	65
42	66
43	67
44	68
45	69
46	70
47	71
48	72
49	73
4A	74
4B	75
4C	76
4D	77

Display	Opening degree (pulse)
4E	78
4F	79
50	80
51	81
52	82
53	83
54	84
55	85
56	86
57	87
58	88
59	89
5A	90
5B	91
5C	92
5D	93
5E	94
5F	95
60	96
61	97
62	98
63	99
64	100
65	101
66	102
67	103

Display	Opening degree (pulse)
68	104
69	105
6A	106
6B	107
6C	108
6D	109
6E	110
6F	111
70	112
71	113
72	114
73	115
74	116
75	117
76	118
77	119
78	120
79	121
7A	122
7B	123
7C	124
7D	125
7E	126
7F	127
80	128
81	129
82	130
83	131
84	132
85	133
86	134
87	135
88	136
89	137
8A	138

Display	Opening degree (pulse)
8B	139
8C	140
8D	141
8E	142
8F	143
90	144
91	145
92	146
93	147
94	148
95	149
96	150
97	151
98	152
99	153
9A	154
9B	155
9C	156
9D	157
9E	158
9F	159
A0	160
A1	161
A2	162
A3	163
A4	164
A5	165
A6	166
A7	167
A8	168
A9	169
AA	170
AB	171
AC	172
AD	173

Display	Opening degree (pulse)
AE	174
AF	175
B0	176
B1	177
B2	178
B3	179
B4	180
B5	181
B6	182
B7	183
B8	184
B9	185
BA	186
BB	187
BC	188
BD	189
BE	190
BF	191
C0	192
C1	193
C2	194
C3	195
C4	196
C5	197
C6	198
C7	199
C8	200
C9	201
CA	202
CB	203
CC	204
CD	205
CE	206
CF	207
D0	208

Display	Opening degree (pulse)
D1	209
D2	210
D3	211
D4	212
D5	213
D6	214
D7	215
D8	216
D9	217
DA	218
DB	219
DC	220
DD	221
DE	222
DF	223
E0	224
E1	225
E2	226
E3	227
E4	228
E5	229
E6	230
E7	231
E8	232
E9	233
EA	234
EB	235
EC	236
ED	237
EE	238
EF	239
F0	240

Table 20-13 ThA, B, C, D and X sensor data

Display	Temperature (°C)
18	–10.000
1C	–9.000
20	–8.000
24	–7.000
28	–6.000
2C	–5.000
30	–4.000
34	–3.000
38	–2.000
3C	–1.000
40	0.000

Display	Temperature (°C)
44	1.000
48	2.000
4C	3.000
50	4.000
54	5.000
58	6.000
5C	7.000
60	8.000
64	9.000
68	10.000
6C	11.000

Display	Temperature (°C)
70	12.000
74	13.000
78	14.000
7C	15.000
80	16.000
84	17.000
88	18.000
8C	19.000
90	20.000
94	21.000
98	22.000

Display	Temperature (°C)
9C	23.000
A0	24.000
A4	25.000
A8	26.000
AC	27.000
B0	28.000
B4	29.000
B8	30.000

Table 20-14 Pressure sensor data

Display	Pressure (kg/cm^2)
17	0.000
1E	1.000
25	2.000
2D	3.000
34	4.000
3B	5.000
43	6.000
4A	7.000
51	8.000
58	9.000
5C	9.500
60	10.000
63	10.500

Display	Pressure (kg/cm^2)
67	11.000
6B	11.500
6E	12.000
72	12.500
76	13.000
79	13.500
7D	14.000
81	14.500
84	15.000
88	15.500
8B	16.000
8F	16.500
93	17.000

Display	Pressure (kg/cm^2)
96	17.500
9A	18.000
9E	18.500
A1	19.000
A5	19.500
A9	20.000
AC	20.500
BD	21.000
B4	21.500
B7	22.000
BB	22.500
BE	23.000
C2	23.500

Display	Pressure (kg/cm^2)
C6	24.000
C9	24.500
CD	25.000
D1	25.500
D4	26.000
D8	26.500
DC	27.000
DF	27.500
E3	28.000
E7	28.500
EA	29.000
EE	29.500
F2	30.000

Note: These are typical samples. It is possible to display the middle value code.

Table 20-15 ThD1, 2 sensor data

Display	Temperature (°C)	Display	Temperature (°C)	Display	Temperature (°C)	Display	Temperature (°C)
05	–5.000	28	40.000	7C	85.000	C6	130.000
07	0.000	30	45.000	87	90.000	CB	135.000
09	5.000	38	50.000	90	95.000	D0	140.000
0C	10.000	41	55.000	9A	100.000		
0F	15.000	4A	60.000	A2	105.000		
12	20.000	54	65.000	AB	110.000		
17	25.000	5E	70.000	B2	115.000		
1C	30.000	68	75.000	B9	120.000		
22	35.000	72	80.000	C0	125.000		

Note: These are the typical samples. It is possible to display middle value code.
Displays "00" when a connector is disconnected or a wire is cut in the sensor.

Table 20-16 ThS, TE, TO sensor data

Display	Temperature (°C)	Display	Temperature (°C)	Display	Temperature (°C)	Display	Temperature (°C)
2A	–20.000	7C	9.000	A2	22.000	C0	35.000
36	–15.000	7F	10.000	A5	23.000	C2	36.000
42	–10.000	82	11.000	A7	24.000	C4	37.000
51	–5.000	85	12.000	AA	25.000	C6	38.000
60	0.000	88	13.000	AC	26.000	C8	39.000
63	1.000	8B	14.000	AF	27.000	C9	40.000
66	2.000	8E	15.000	B1	28.000	D1	45.000
69	3.000	91	16.000	B3	29.000	D8	50.000
6C	4.000	94	17.000	B6	30.000	DE	55.000
6F	5.000	97	18.000	B8	31.000	E3	60.000
73	6.000	9A	19.000	BA	32.000	E7	65.000
76	7.000	9C	20.000	BC	33.000	EA	70.000
79	8.000	9F	21.000	BE	34.000		

Note: There are the typical samples. It is possible to display middle value code.
Displays "00" when a connector is disconnected or a wire is cut in the sensor.

21.OTHERS

21-1. Microprocessor System Diagram and the Time Required to Judge the Malfunction

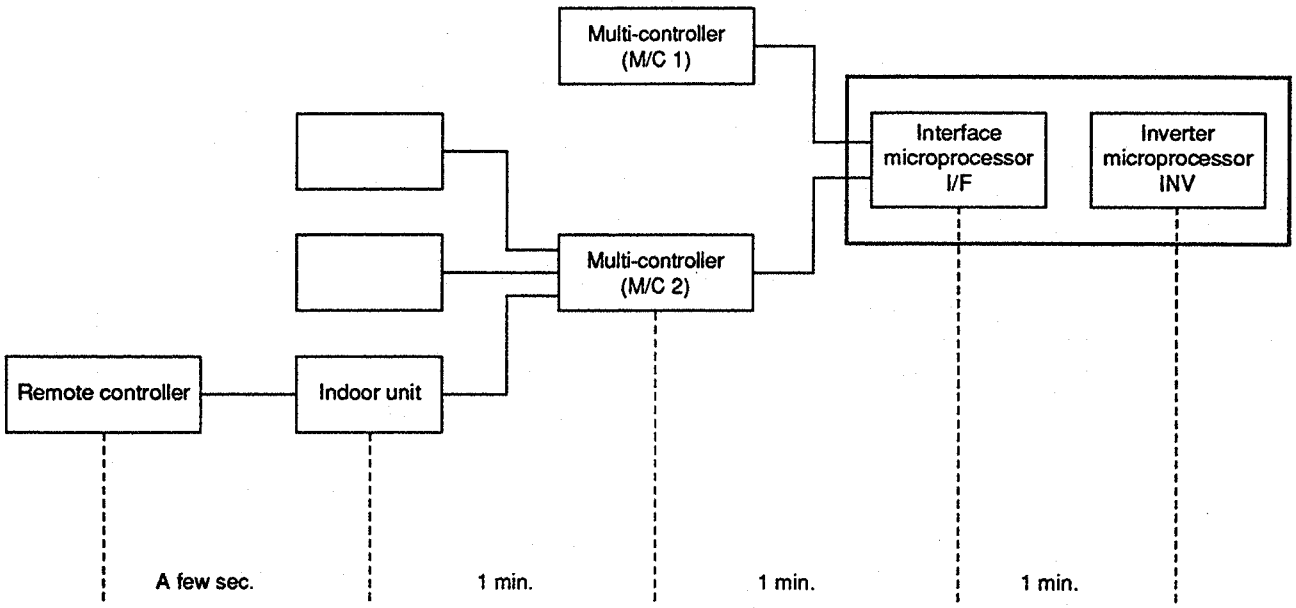


Fig. 21-1

The time to display the indication on the remote controller.

Serial signal abnormalities:

(1) Between the I/F and the INV

a few seconds + one minute + one minute + one minute = **more than three minutes**

(2) M/C and the I/F

a few seconds + one minute + one minute = **more than two minutes**

(3) Indoor unit and the M/C

a few seconds + one minute = **more than one minute**

(4) The remote control and indoor units

a few seconds

INV abnormalities:

a little more than three minutes

I/F abnormalities:

a little more than two minutes

M/C and indoor unit microprocessor abnormalities:

a little more than one minutes

21-2. A Check of the Control Circuit Power Voltage of the Multi-Controller Control Board

There are two types of control circuit power voltages, 5V and 12V. (Common GND).

5V: ..... Electronic circuit power

12V: ..... Relay drive circuit, power for the PMV

Measure the voltage between the GND and the checkpoints shown in Fig. 21-2.

When there is no voltage, take off PJ16 (in condition without loading), measure the transformer secondary voltage. When approximately 18 – 20V AC (at 240V) is detected, the relay board is defective, otherwise, transformer defects.

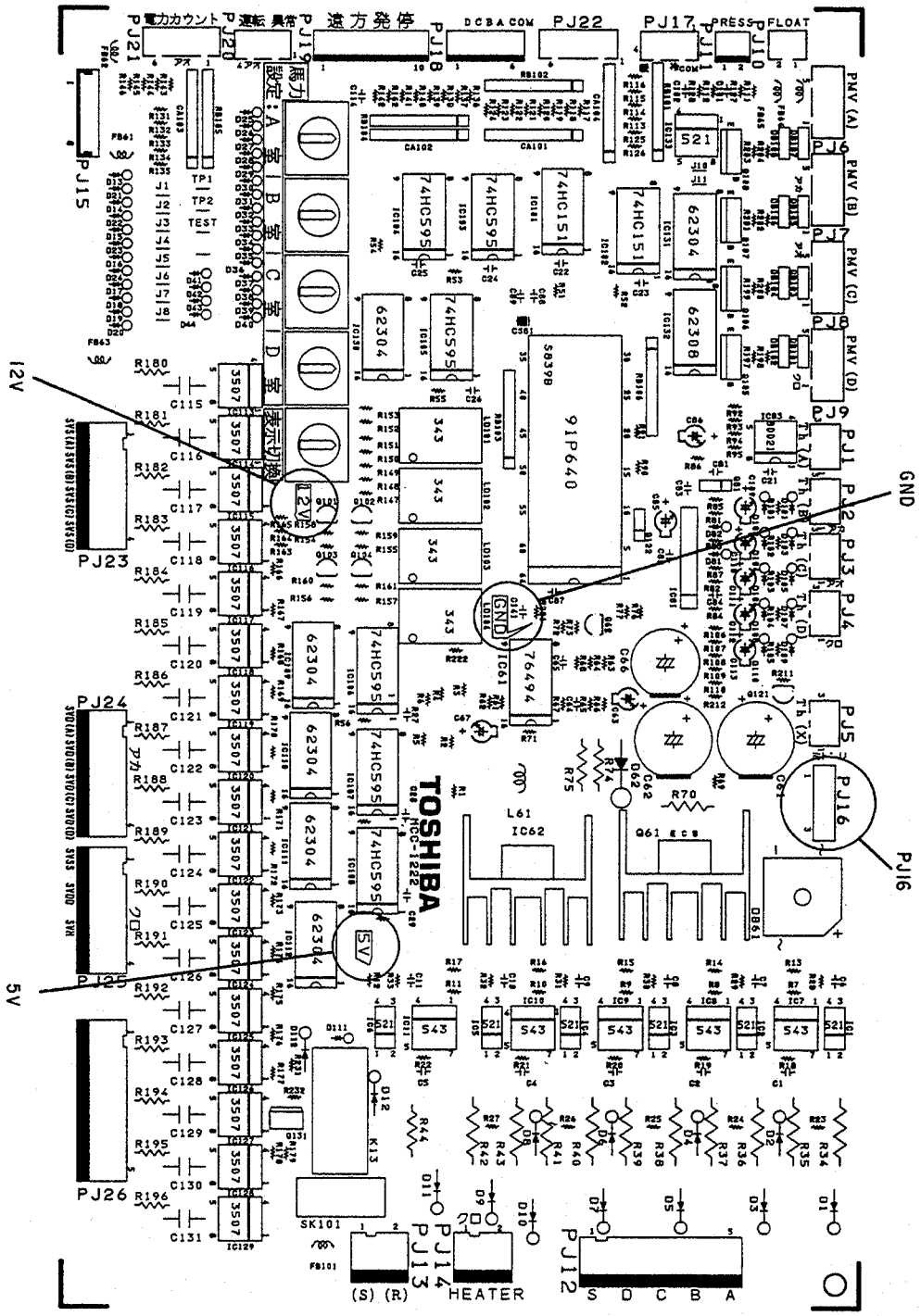


Fig. 21-2

21-3. A Check of the Control Circuit Power Voltage of the Outdoor Interface Board

There are two types of control circuit power voltages, 5V and 12V. (Common GND).

5V: .....Electronic circuit power

12V: .....Relay drive circuit, power for the PMV

Measure the voltage between the GND and the checkpoints shown in Fig. 21-3.

When there is no voltage, take off PJ8 (in condition without loading), measure the transformer secondary voltage. When approximately 18 – 20V AC (at 240V) is detected, the relay board is defective, otherwise, transformer defects.

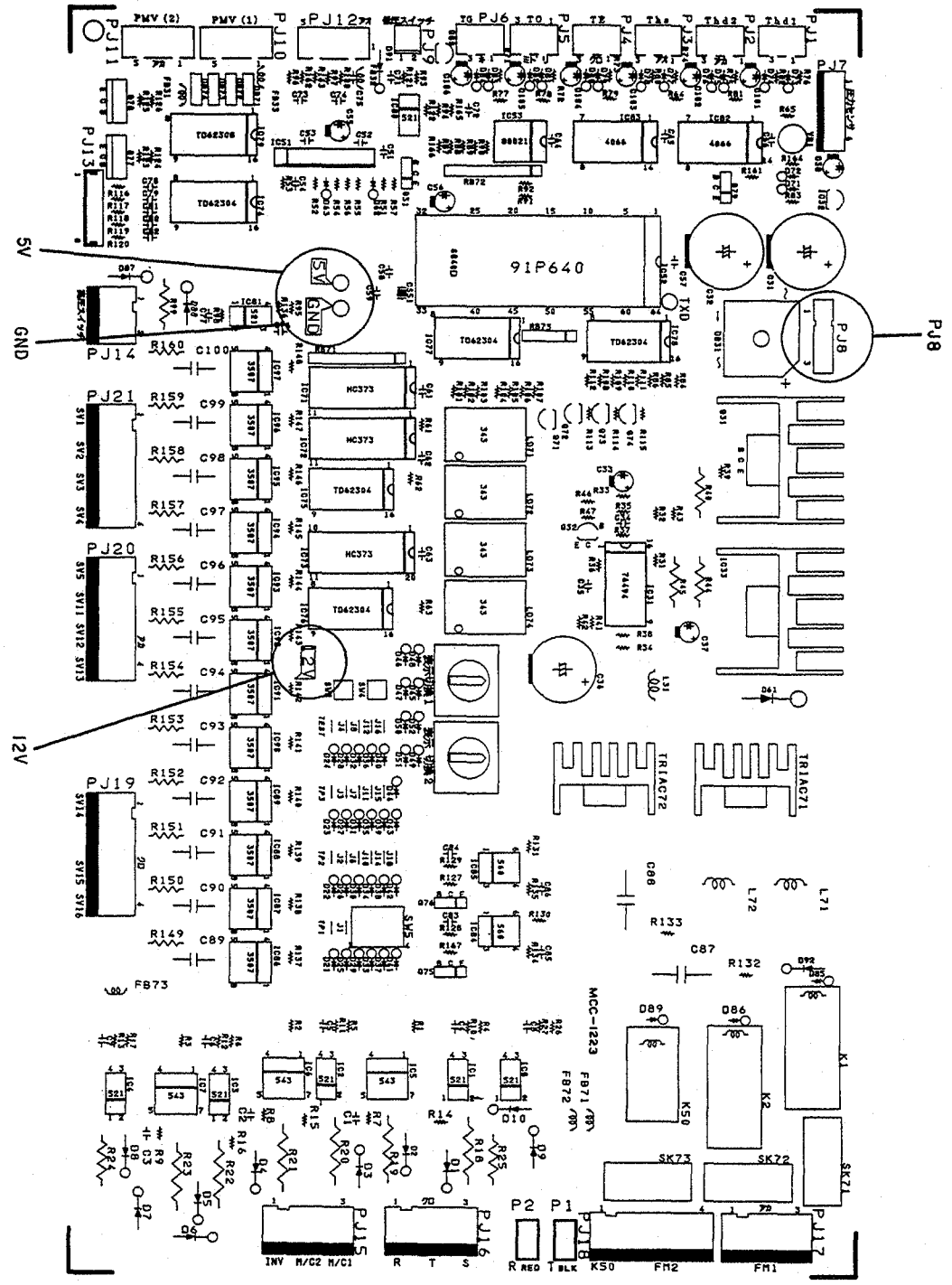


Fig. 21-3

21-4. 220 – 240V System Diagram

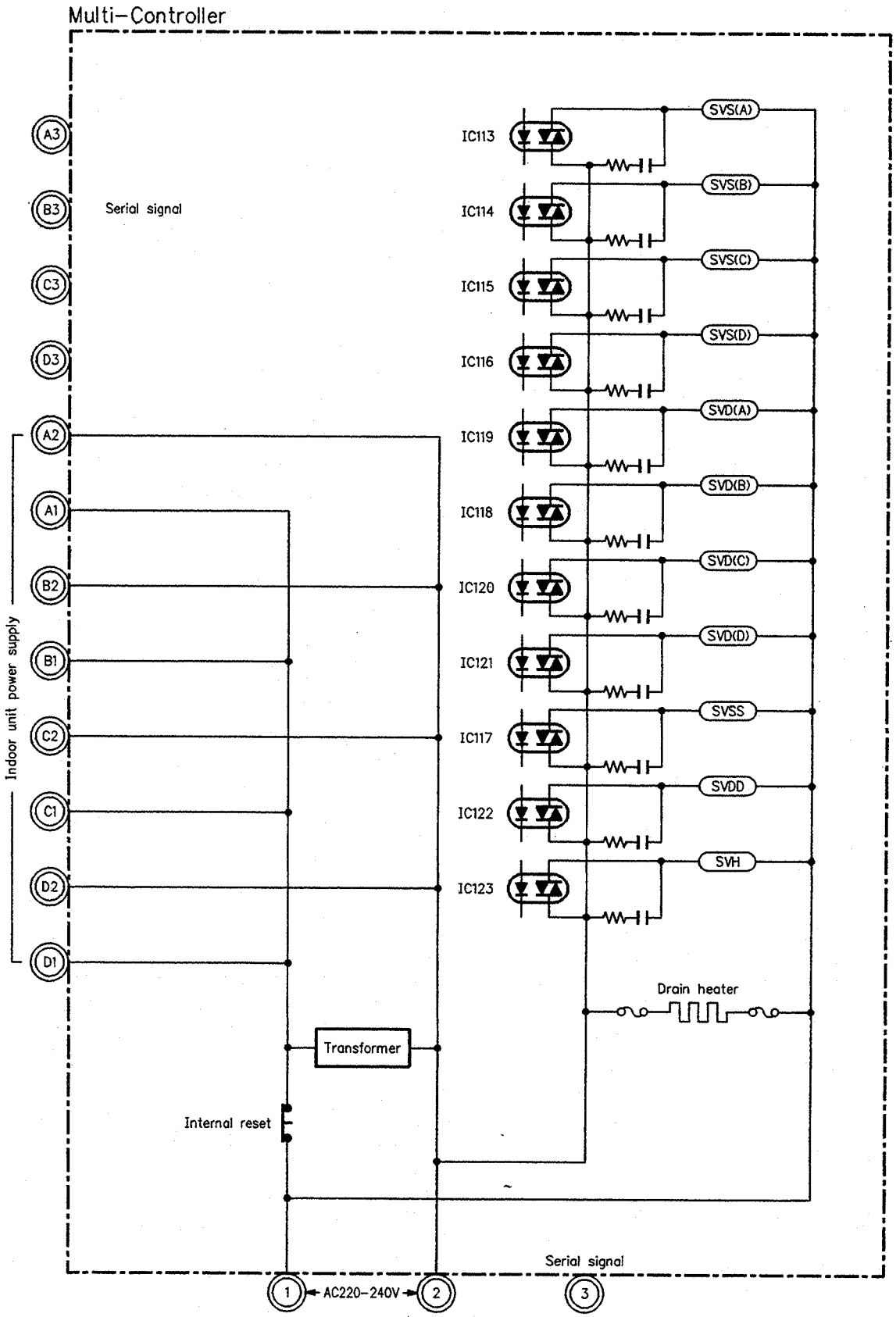


Fig. 21-4 Multi-controller

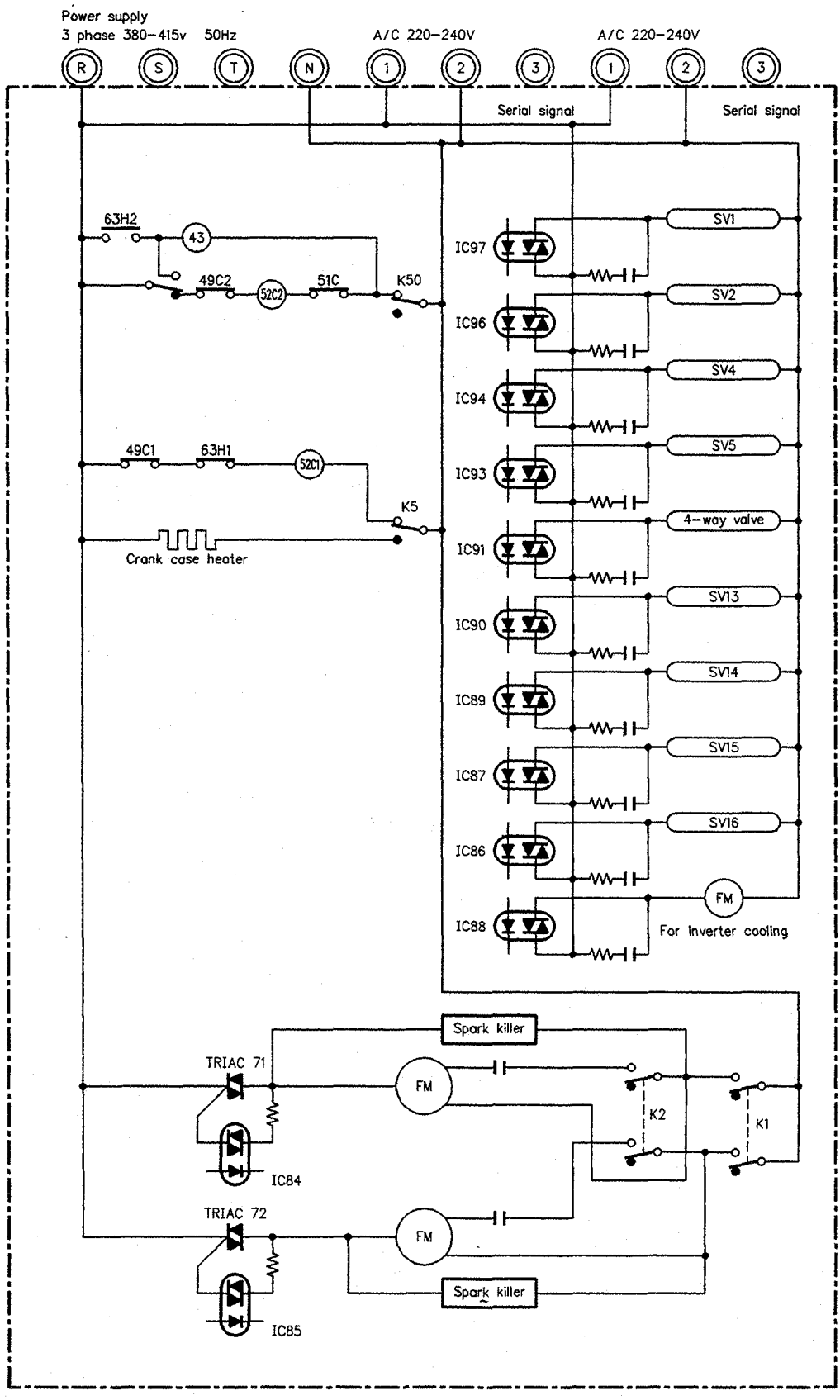


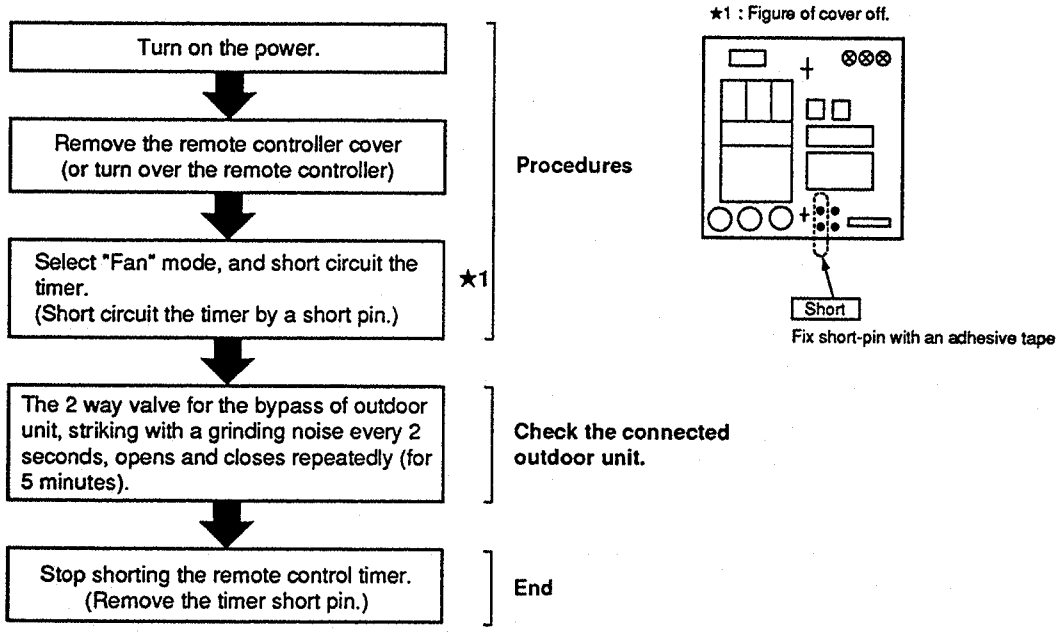
Fig. 21-5 Outdoor unit

22.REMOTE CONTROLLER DISCRIMINATION FUNCTION, OUTDOOR UNIT DISCRIMINATION FUNCTION

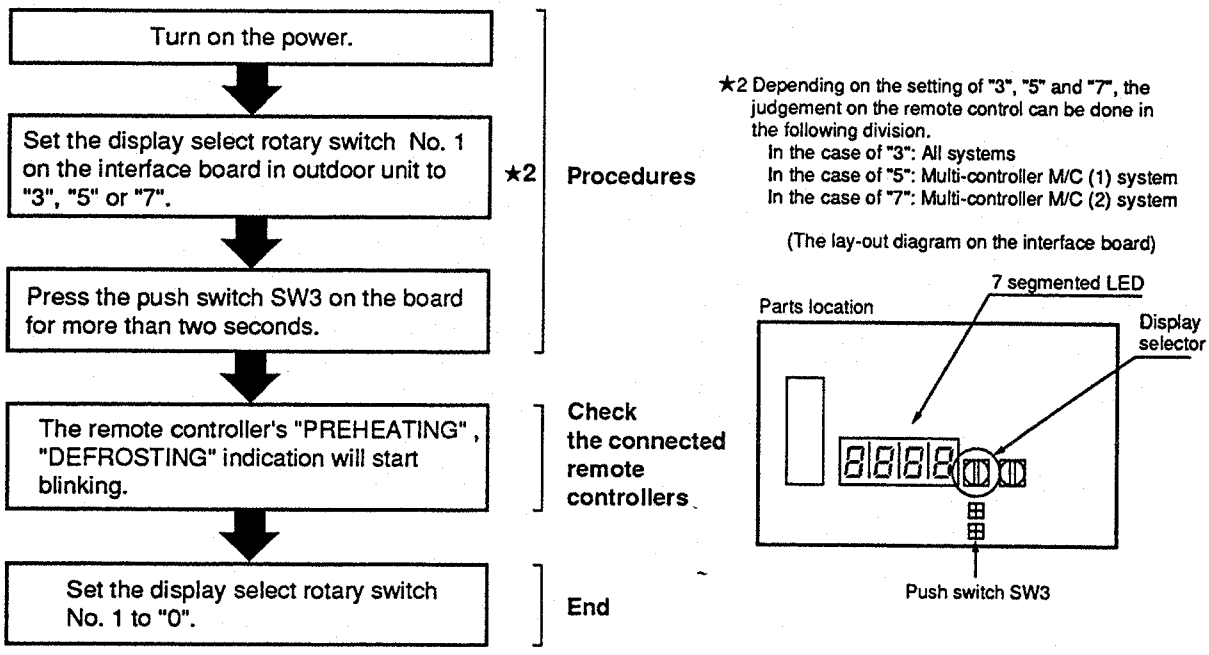
For each of one outdoor unit system, it is possible;

- To search for connected outdoor unit from the remote controller.
- T o search for connected remote controllers from the outdoor unit.

22-1. Search from the Remote Controller


Turn on the power.
Remove the remote controller cover (or turn over the remote controller)
Select "Fan" mode, and short circuit the timer. (Short circuit the timer by a short pin.)
★1
Procedures
The 2 way valve for the bypass of outdoor unit, striking with a grinding noise every 2 seconds, opens and closes repeatedly (for 5 minutes).
Check the connected outdoor unit.
Stop shorting the remote control timer. (Remove the timer short pin.)
End
★1 : Figure of cover off.
Short
Fix short-pin with an adhesive tape

22-2. Search from Outdoor Unit


Turn on the power.
Set the display select rotary switch No. 1 on the interface board in outdoor unit to "3", "5" or "7".
★2
Procedures
Press the push switch SW3 on the board for more than two seconds.
The remote controller's "PREHEATING", "DEFROSTING" indication will start blinking.
Check the connected remote controllers.
Set the display select rotary switch No. 1 to "0".
End
★2 Depending on the setting of "3", "5" and "7", the judgement on the remote control can be done in the following division.
In the case of "3": All systems
In the case of "5": Multi-controller M/C (1) system
In the case of "7": Multi-controller M/C (2) system
(The lay-out diagram on the interface board)
7 segmented LED
Parts location
Display selector
Push switch SW3

23. CHECK FOR REFRIGERANT PIPING AND INTER-UNIT WIRING CONNECTION

The units have a function to check the wrong connection of refrigerant piping and inter-unit wiring between multi-controller and indoor units. Conduct the check at the test run as follows. This function does not work in the cases listed below.

Cases:
1. The capacity of indoor units set to "0". (Select the correct capacity with the switches on the multi-controller control board.)
2. Remote controller of indoor unit did not set to "cooling" (Select "cooling")
3. Out of phase in inter-unit wiring, or wrong connection (Connect the wire to correct terminal number)

23-1. Check System Procedures

1 — **Turn the power on.**

2 — **Open the electrical parts box in the outdoor unit.**

3 Frequency setting — Set up the operation frequencies. Depending on the room and ambient temperatures, set the rotary switch (display switch) on the interface (I/F) board in the outdoor unit to either "9" or "10".

4 Set up the operation — Set all the remote controllers of indoor units connected to the outdoor unit to cooling operation, and press the operation button. (No need for temperature setting)

5 Start the check — Press the push SW No.3 on the I/F board. (More than two seconds) (Eight LEDs on the I/F board in outdoor unit will simultaneously start to blink.) (Start to check with indoor unit A and carry on in turn. During the check, all of the indoor unit's remote controllers display "PREHEAT", "DEFROST" blinking, and the indoor unit fan keeps to stop operation.)

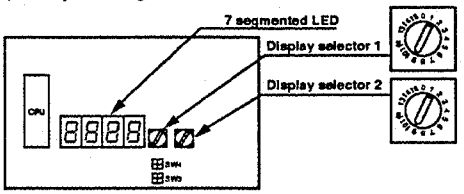
6 End of the check — After completion of the operation lamp on the remote controller goes off. As for the outdoor unit, the compressor stops the operation and the seven segmented LEDs on the I/F board also stop blinking.

7 Judgement — Check, a wrong wiring or not. In the case of wrong wiring, 7 segmented LEDs indicate the defective indoor unit. You can also use 7 segmented LEDs on the multi-controller for this check. It takes max. 10 minutes for the check. But it varies depending on room and ambient air temperature.

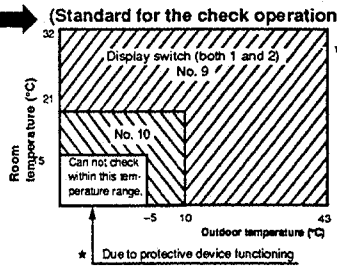
8 Reset — When the check is completed, make sure to return the rotary SW on the I/F board to "0". (If it is not returned to "0", the wrong connection check will finish as it is, and it won't be possible to do the cooling or the heating operation.)

Note: When there are some wrong connections, repair them after turning off the power and perform a check again.

(The lay-out diagram for the switch on the interface board)



(Standard for the check operation frequency selection.)



* When the pressure fall down due to low indoor and outdoor temperature or under-charge of refrigerant gas, the operation of the compressor will be stopped by protective device functioning, and the check will come to a halt. But LED on I/F board continues blinking as it is.

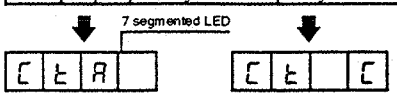
(7 segmented LED indication on the I/F board.)

Display switch (both 1 and 2) No. 9 or 10	LD71	LD72	LD73	LD74
	1	Displays the unit with wrong connection	2	Displays the unit with wrong connection

(Example) If there is no wrong connection in M/C (1) system, "C" is displayed.
When there are wrong connections in unit C and D, "C" and "d" will be alternately displayed every two seconds.

(The two digit, 7 segmented LED display on the multi-controller board)

Display switch No. 6	LD101	LD102	LD103	LD104
	C	E	Displays the unit under checking	Displays the unit with wrong connection



(Example) When there are wrong connections in unit C and D, "C" and "d" will be alternately displayed every two seconds.
If there are wrong connections in all of the unit A, B, C and D, all the symbols are displayed every two seconds.

24.REMOVAL METHOD

24-1. Outdoor Unit (MAR-F81HTM8, F101HTM8)

24-1-1. Replacement and Checking Procedures of the Electrical Parts

Danger:
- The electrolytic capacitors in the electrical parts assembly are charged to 600 volts D.C. Before servicing, turn off the power supply and allow at least 20 minutes for the capacitors discharging to a safe level of 5 volts D.C. or less to avoid possible hazard.
- Test with a D.C. volt meter as shown below.

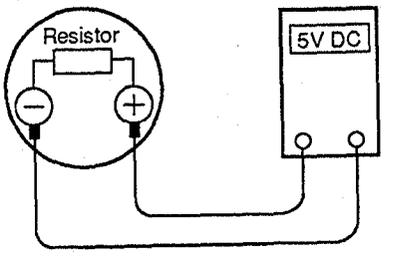


Fig. 24-1

- Never short the capacitor terminals with any metal implement for discharging. Personal injury or equipment damage may result.

(1) Remove the front panel (left side). (M6 x 4, M4 x 1)

(2) Remove the inverter cover. (M4 x 4)

24-1-2. Replacement Procedures of the Propeller Fan and Fan Motor

(1) Remove the fan guard. (M4 x 2, 2 locations)

(2) Loosen the tightening screws of the propeller fan with a hexagonal wrench and remove the propeller fan upward.

(3) After removing the fan motor lead connector inside the inverter assembly, remove the fan motor from the ventilation unit base. (M6 x 4, 2 locations)

24-1-3. Replacement Procedures of the compressor unit

(1) Remove the front panels (left and right sides). (M6 x 4, 2 locations, M4 x 1)

(2) Purge the refrigerant.

(3) Remove the inverter cooling duct. (M6 x 2)

(4) Remove the strut (front). (M6 x 9, M4 x 1)

(5) Remove the upper cover of the inverter unit.

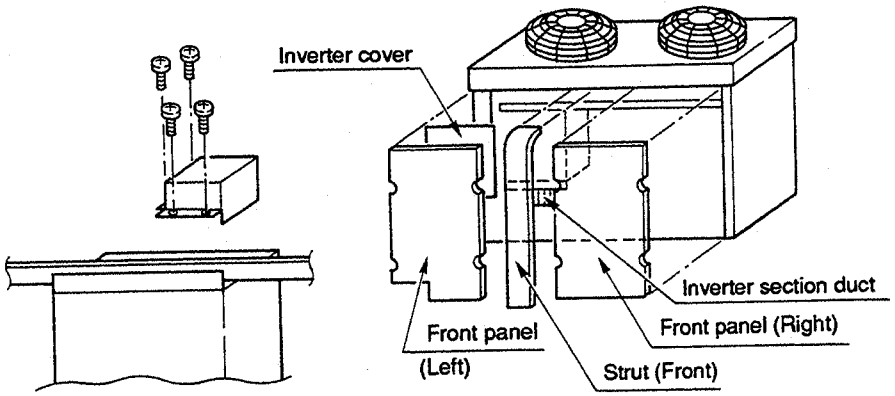


Fig. 24-2

(6) Remove the fixing screws of the inverter assembly. (M4 x 2)

(7) Remove all the connectors of 2-way valve coil lead and etc. inside the inverter assembly.

(8) Remove the inverter assembly to the front.

(9) Remove the noise reduction box (A). (M4 x 7)

(10) Remove the noise reduction box (B). (M4 x 4)

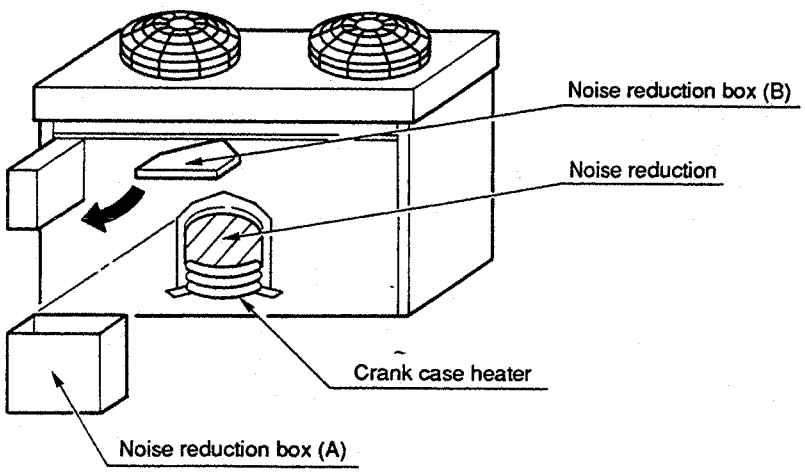


Fig. 24-3

(11) Remove the noise reduction material and crank case heater.

(12) Remove the discharge temperature sensors (2 locations on left and right side) mounting on the discharge pipe and remove the discharge pipe from the compressor.

(13) Remove the suction temperature sensor (1 location) mounting on the suction pipe and remove the suction pipe from the compressor. (2 locations)

(14) Remove the equalizer pipe on the suction pipe.

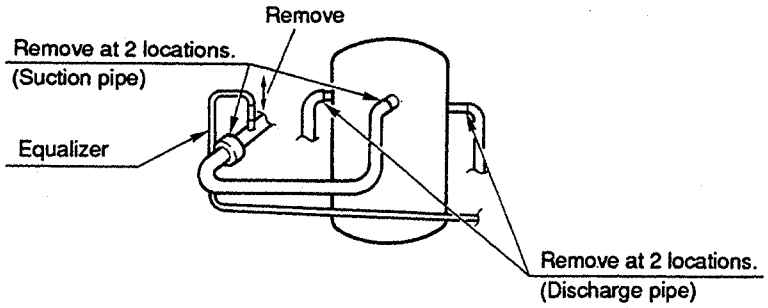


Fig. 24-4

(15) Loosen the compressor fixing nuts (M10 x 3) and remove them. (M10 x 3)

(16) Remove the connection lead wires on the compressor and terminal sections.

(17) Insert a rectangular lumber or etc. (as carrying guides.) under the bottom of the compressor leaning the compressor.

(18) Move forward the compressor rolling left and right by using the hooks for hanging.

(19) Replace the compressor.

(20) After replacing the compressor, perform the procedures in reverse order of removal.

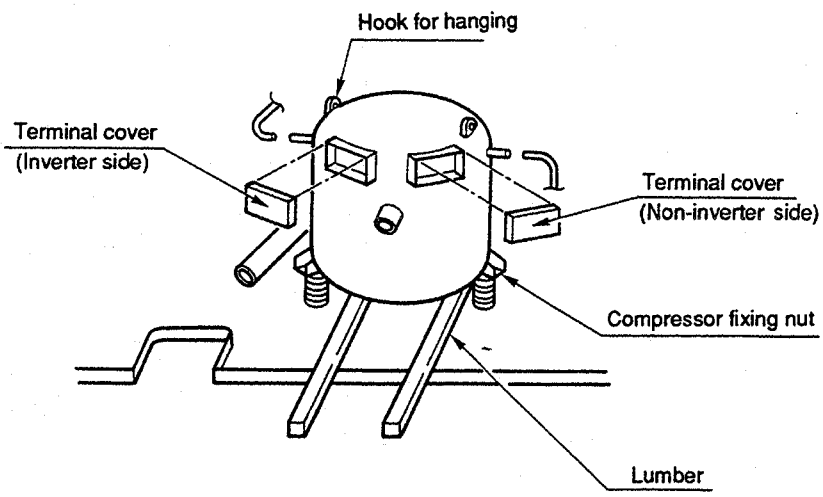


Fig. 24-5

24-1-4. Replacement Procedures of the Accumulator

(1) Remove the front panel (left and right side). (M6 x 4, 2 locations, M4 x 1)

(2) Purge the refrigerant.

(3) Remove the inverter assembly forward according to the procedures described in item 24-1-3.

(4) Remove the pipes connected to the accumulator.

(5) Remove the accumulator fixing screw. (M6 x 1)

(6) Replace the accumulator.

24-1-5. Replacement Procedures of the Liquid Tank

(1) Remove the front panel (left and right side). (M6 x 4, 2 locations, M4 x 1)

(2) Purge the refrigerant.

(3) Remove the pipe connected to the liquid tank.

(4) Remove the liquid tank fixing screws. (M6 x 2)

(5) Replace the liquid tank.

24-1-6. Replacement Procedures of the Heat Exchanger

(1) Remove the front panel (left and right side). (M6 x 4, M4 x 1)

(2) Purge the refrigerant

(3) Pull the replacing outdoor unit out from the coupled outdoor units.

(4) Remove the front panel (right), the exhaust air cabinet, the side plate (right and left), the strut (back), and the ventilation assembly.

(5) Replace the heat exchangers (upper right, lower right, upper left, lower left). (M4 x 8, 2 locations)

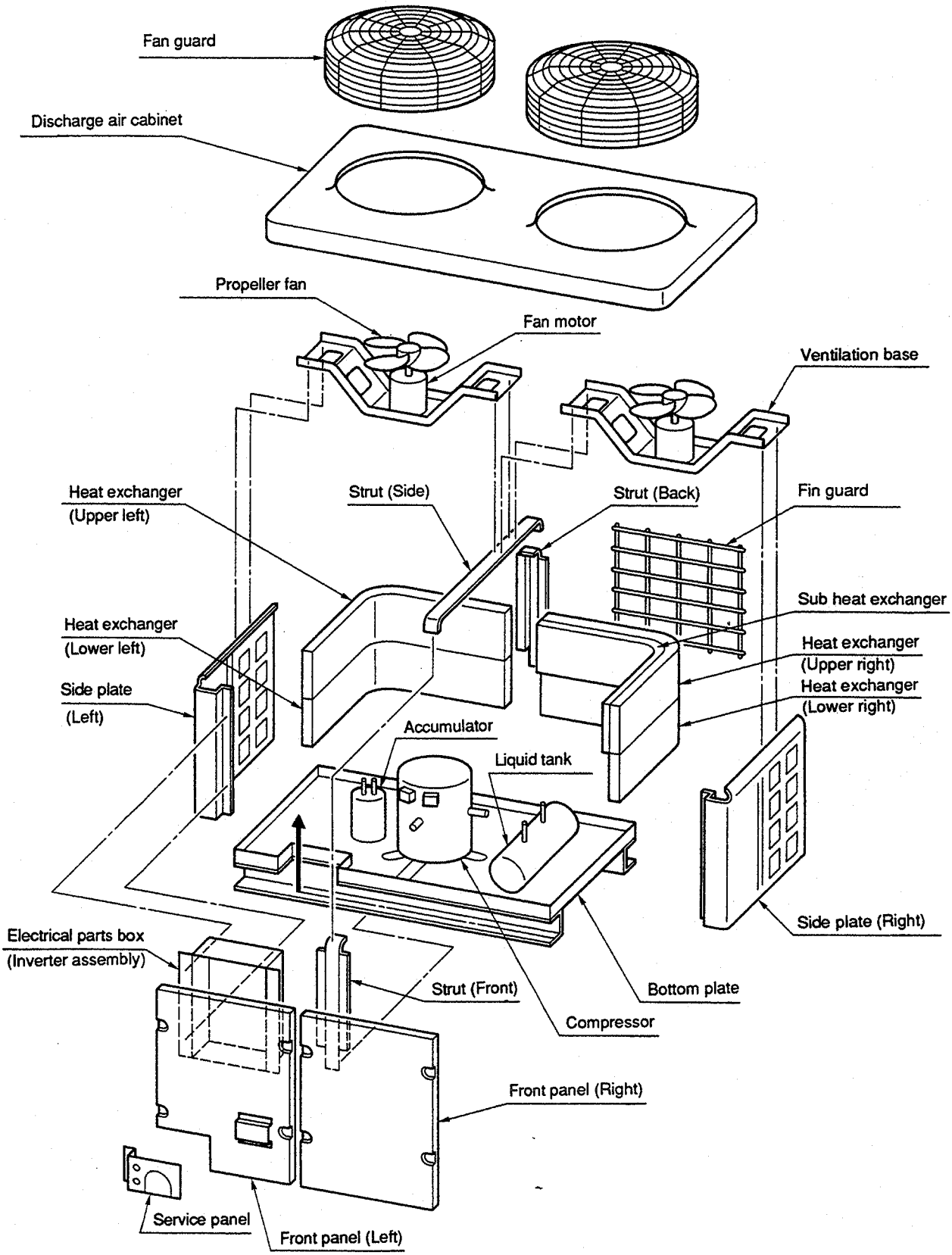

Fan guard
Discharge air cabinet
Propeller fan
Fan motor
Ventilation base
Heat exchanger
(Upper left)
Strut (Side)
Strut (Back)
Fin guard
Sub heat exchanger
Heat exchanger
(Lower left)
Heat exchanger
(Upper right)
Heat exchanger
(Lower right)
Side plate
(Left)
Accumulator
Liquid tank
Side plate (Right)
Electrical parts box
(Inverter assembly)
Strut (Front)
Bottom plate
Compressor
Front panel (Right)
Service panel
Front panel (Left)

Fig. 24-6

24-2. Multi-Controller (RBM-Y1031FE, Y1041FE)

24-2-1. Replacement and Checking Procedures of the Electrical Parts

(1) Remove the electrical parts box cover.

24-2-2. Checking Procedures of the Refrigerant Cycle Parts

(1) Remove the electrical parts box cover.

(2) Remove the electrical parts box cover mounting screws (M4 x 2) and remove the electrical parts box cover from the unit holding the electrical parts upward.

(3) Hook the removed electrical parts box on the base of the unit and fix it. (Refer to Fig. 24-8)

(4) Remove the unit cover. (M4 x 4)

Note: When the electrical parts box is removed, remove the PMV A – D connectors (PJ6 – PJ9), the temperature sensor (Th A – D, ThX) connectors (PJ1 – PJ5), the heater connector (PJ14) and SVD (A – D) connectors, SVS (A – D) connectors, SVSS, SVDD, SVH connectors after performing item (1), and then perform item (2) and remove the electrical parts box.

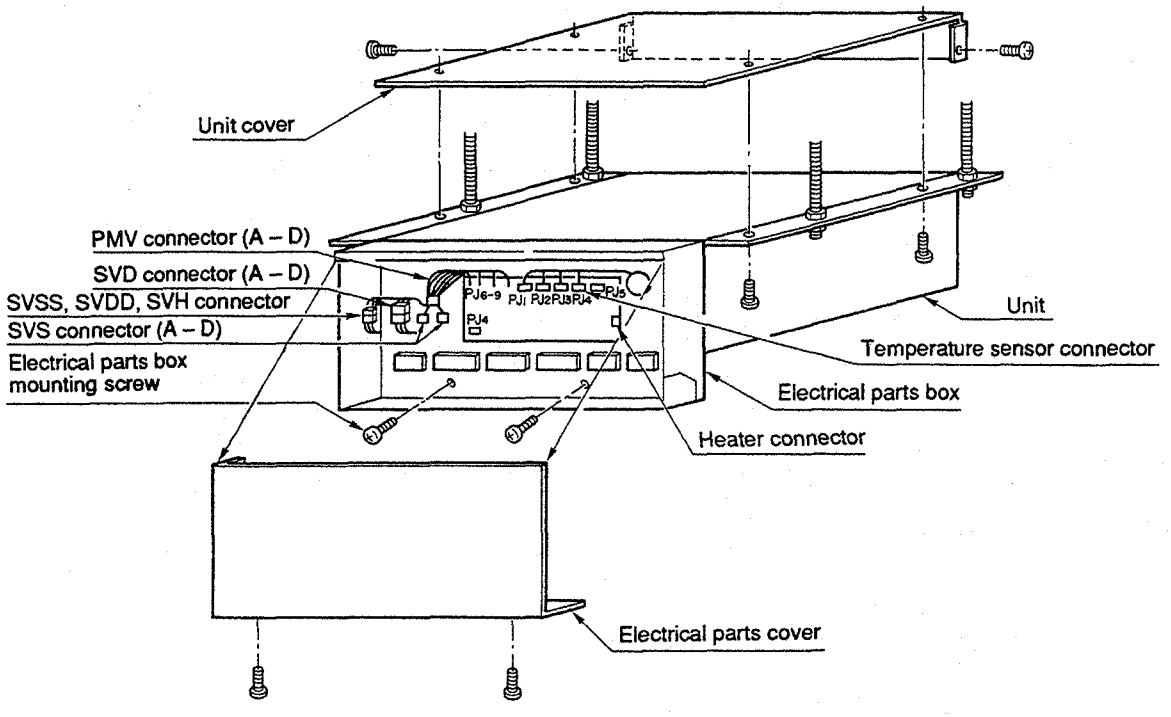


Fig. 24-7

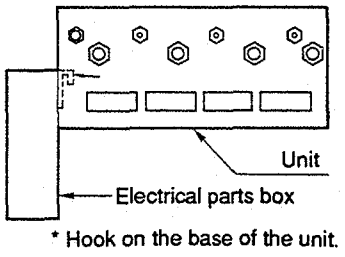


Fig. 24-8

24-2-3. Replacement Procedures of the Refrigerant Cycle Parts

(1) Purge the refrigerant from the outdoor unit.

(2) Remove the refrigerant pipes and the inter-unit wiring connections.

(3) Bring down the multi-controller from the ceiling.

Note:
1. Replacement of the refrigerant cycle parts should be performed with the multi-controller brought down from the ceiling.
2. Replacement of PMV, the expansion valve, the check valve, the magnetic valve should be performed while cooling the valve main body by wet clothes.
3. For locations of the parts, please see the parts lists.

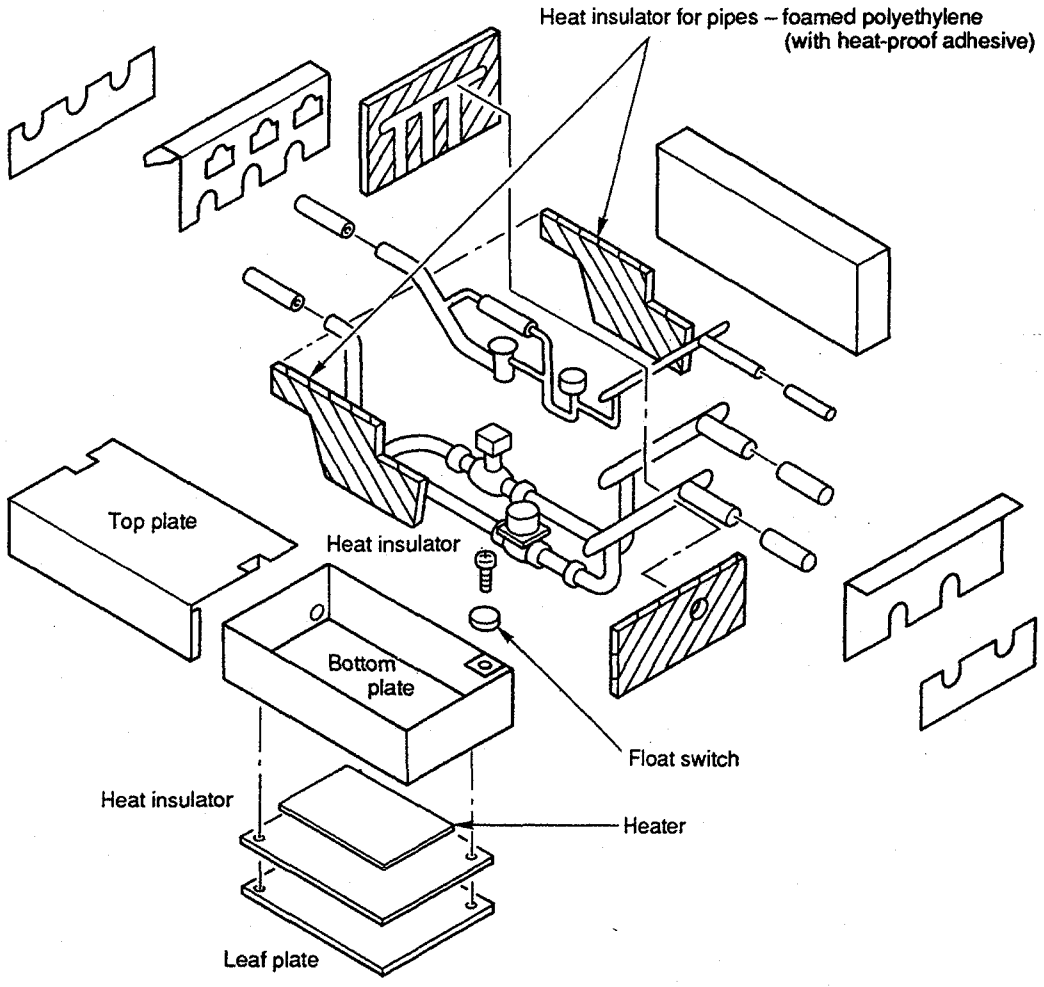


Fig. 24-9

24-2-4. Replacement Procedures of the Heater

(1) Remove the leaf plate. (M4 x 6)

(2) Remove the heater connector PJ14 (on the PC board) and replace the heater.

(3) Insert the connector of the new heater into PJ14 on the PC board and mount the leaf plate.

Note: 1. Before attaching a new heater, completely clean residual adhesive on the bottom plate.
2. Glue the new heater so that it does exceed the heat insulators and leaf plate and clamp at the exit side without catching the heater leads.

24-2-5. Replacement Procedures of the Pipe Heat Insulators

(1) Remove the unit cover. (M4 x 4)

(2) Peel off the pipe heat insulators to be replaced with a knife or etc.

(3) Remove an adhesive seal of the new pipe heat insulator and attach the insulators surely on the pipe without slipping off.

24-2-6. Replacement Procedures of the Float Switch

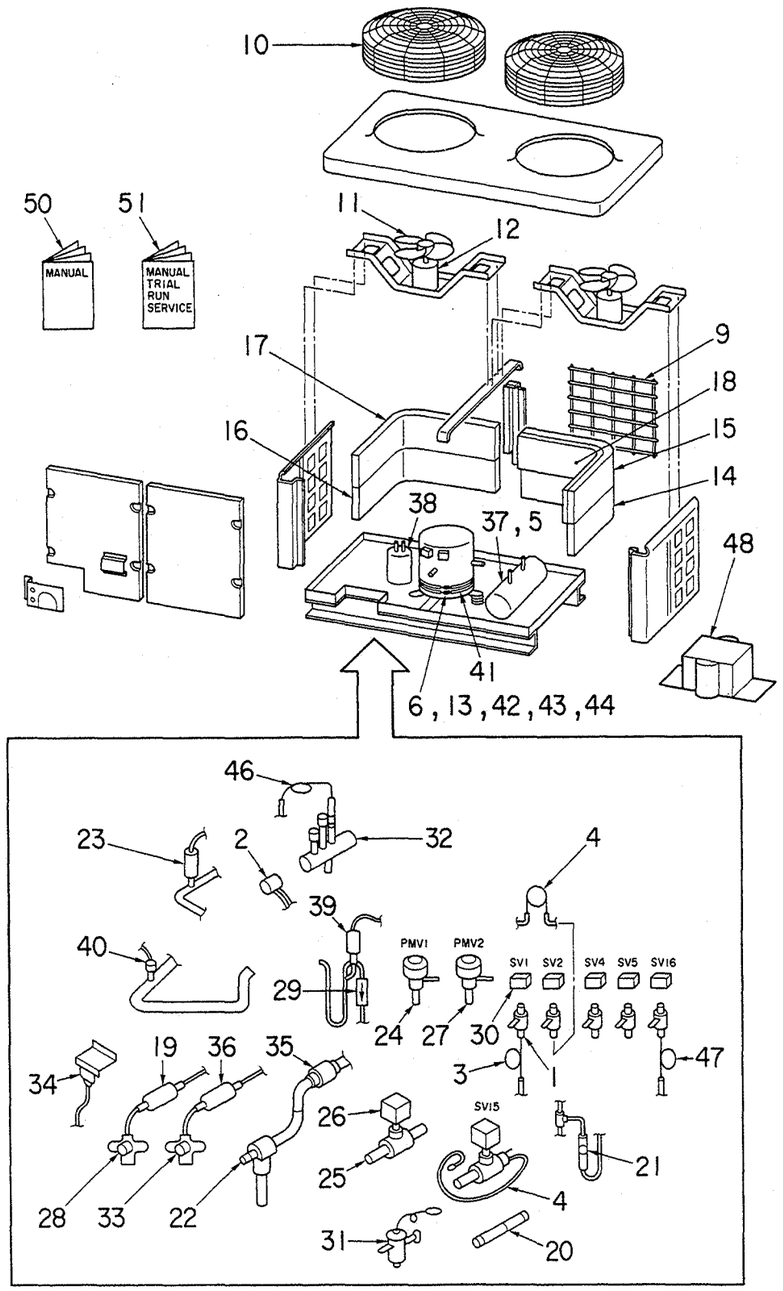
(1) Loosen the screws of the float switch and remove the float switch from the bottom plate.

(2) Remove the float switch connector PJ10 (on the PC board).

(3) Replace the float switch and mount it according to the reverse order (2) – (1).

25.EXPLODED VIEWS AND PARTS LIST

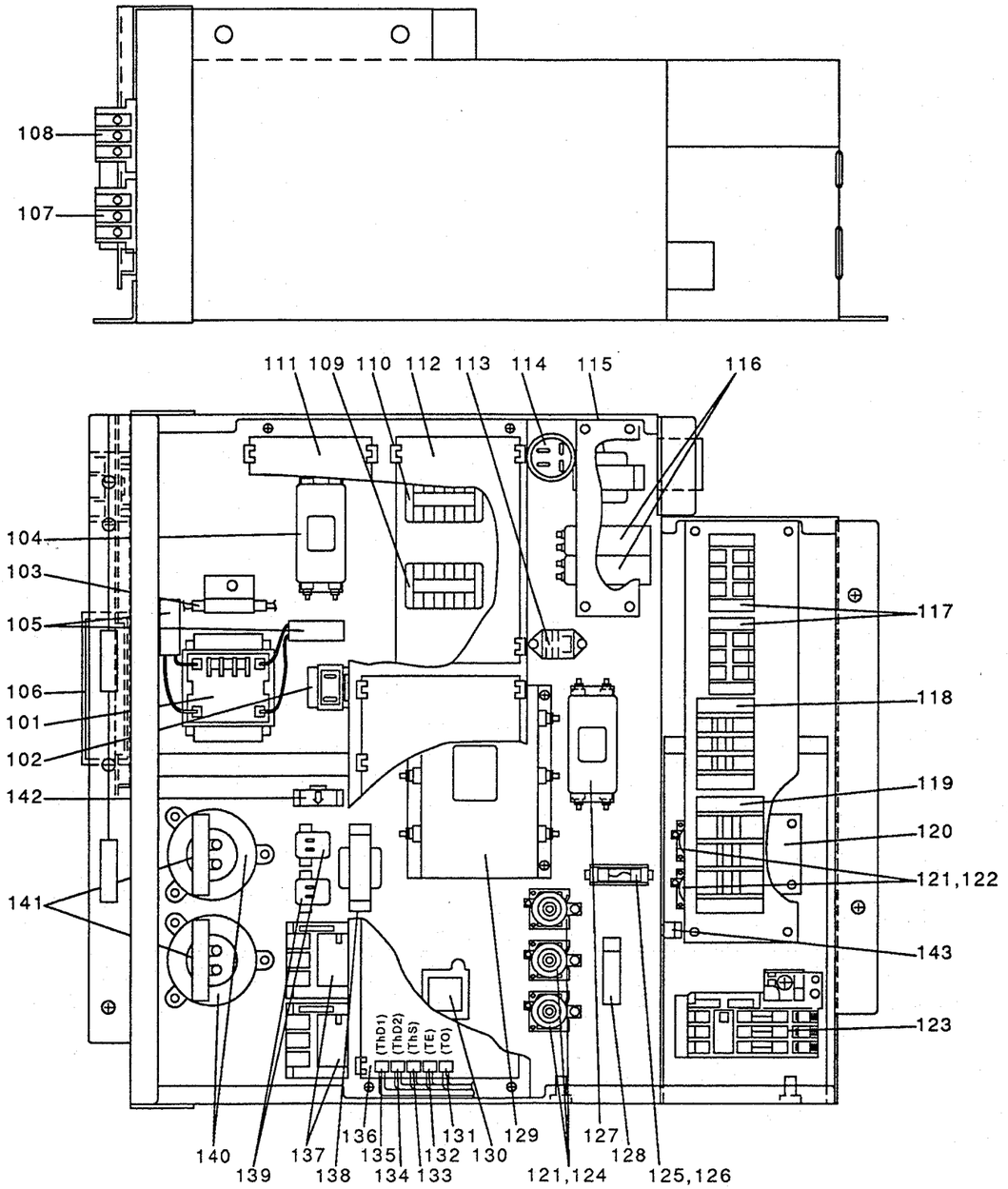
25-1. Outdoor Units (MAR-F81HTM8,MAR-F101HTM8)



Location No.	Part No.	Description
1	43046151	2-Way Valve
2	43046255	Solenoid Coil, 4-Way Valve
3	43047491	Capillary Tube 1.5 Diameter
4	43047527	Capillary Tube 2.0 Diameter
5	43048009	Fusible Plug
6	43107200	Spring, Base
9	43119391	Fin Guard
10	43119392	Fan Guard
11	43120170	Propeller Fan
12	43121545	Fan Motor, STF-200-150C
13	43141603	Compressor, HV990CW-Y12 (MAR-F81HTM8)
13	43141702	Compressor, HV1200CW-Y12 (MAR-F101HTM8)
14.	43143572	Condenser, Right-Lower (MAR-F81HTM8)
14	43143557	Compressor, Right-Lower (MAR-F101HTM8)
15	4314573	Condenser, Right-Upper (MAR-F81HTM8)
15	43143558	Condenser, Right-Upper (MAR-F101HTM8)
16	43143574	Condenser, Left-Lower (MAR-F81HTM8)
16	43143559	Condenser, Left-Lower (MAR-F101HTM8)
17	43143575	Condenser, Left-Upper (MAR-F81HTM8)
17	43143560	Condenser, Left-Upper (MAR-F101HTM8)
18	43143576	Condenser, Sub (MAR-F81HTM)
18	43143562	Condenser, Sub (MAR-F101HTM8)
19	43145066	Dryer

Location No.	Part No.	Description
20	43146252	Check Valve
21	43146283	Check Valve
22	43146351	Service Valve
23	43146367	Switch, High Pressure
24	43146397	Pulse Motor Valve
25	43146398	Valve Body
26	43146506	Solenoid Coil
27	43146404	Pulse Motor Valve
28	43146503	Packed Valve (5/8")
29	43146428	Check Valve
30	43146443	Solenoid Coil
31	43146427	Expansion Valve (MAR-F81HTM8)
31	43146444	Expansion Valve (MAR-F101HTM8)
32	43146446	4-Way Valve
33	43146504	Packed Valve (3/4")
34	43146458	Sensor, Pressure
35	43147529	Strainer
36	43147537	Strainer
37	43148123	Liquid Tank (MAR-F81HTM8)
37	43148120	Liquid Tank (MAR-F101HTM8)
38	43148122	Accumulator (MAR-F81HTM8)
38	43148121	Accumulator (MAR-F101HTM8)
39	43151229	Switch, High Pressure
40	43151230	Switch, Low Pressure
41	43157254	Heater, Crank Case
42	43195185	Cushion, Under, Compressor
43	43195186	Cushion, Upper, Compressor
44	43195198	Spacer
46	44246235	Capillary Tube 0.8 Diameter
47	44246236	Capillary Tube 1.0 Diameter
48	43155136	Reactor
50	43188856	Owner's Manual
51	43188859	Manual, Trial Run and Service

25-2. Electrical Parts Assembly (MAR-F81HTM8, MAR-F101HTM8)

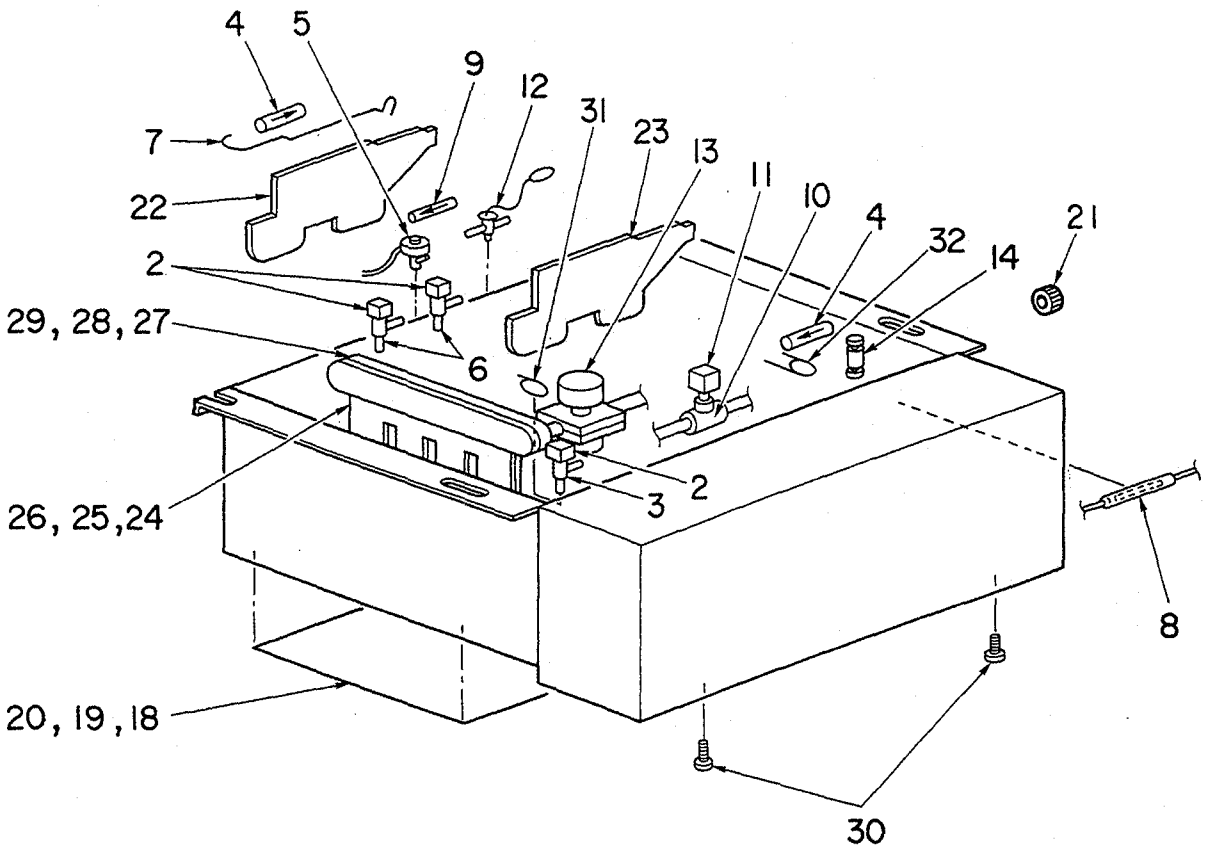


Location No.	Part No.	Description
101	43131031	G-Transistor, MG50Q6ES11
102	43169622	Rectifier, 30U6P42
103	43150214	TRS-Thermostat , TRC TR-100B10SPT3A
104	43169617	Noise Filter, DC
105	43169619	Diode Clipper Assembly
106	43169613	Fan Motor
107	43160438	Terminal
108	43160450	Terminal, 3P (L1, L2)
109	43160447	Terminal, 6P
110	43160448	Terminal, 6P
111	43169624	PC Board, MCC-1252, Gate
112	43169623	PC Board, MCC-1251, Control
113	43154156	Relay, LY-1F
114	43155135	Noise Filter
115	43158127	Transformer FT57
116	43155134	Capacitor, MF
117	43060750	Terminal Block, 3P
118	43160449	Terminal, 3P (N)
119	43160426	Terminal Block, 3P (RST)
120	43169625	PC Board, MCC-1253, Surge
121	43160451	Holder, Fuse
122	43160452	Fuse
123	43142312	Magnetic Contactor (MAR-F81HTM8)

Location No.	Part No.	Description
123	43152356	Magnetic Contactor (MAR-F101HTM8)
124	43160453	Fuse
125	43460526	Fuse
126	43060859	Fuse Block
127	43169618	Noise Filter
128	43169620	Ferrite Core
129	43169616	Noise Filter, AC
130	43154148	Return Lock STR-4AB
131	43150172	TC Sensor
132	43150173	TC Sensor
133	43150171	TC Sensor
134	43150176	Sensor
135	43150175	Sensor
136	43169628	PC Board, MCC-1223, Interface
137	43152334	Magnetic Contactor
138	43158129	Transformer FT13-2
139	43169612	Starter
★ 140	43169621	Capacitor, LNT2G222KSMCTF
141	43169614	SEM Resistor
142	43169615	Hole-CT
143	43055392	Surge Absorber

★ **Note:** Replace both two capacitors at a time.

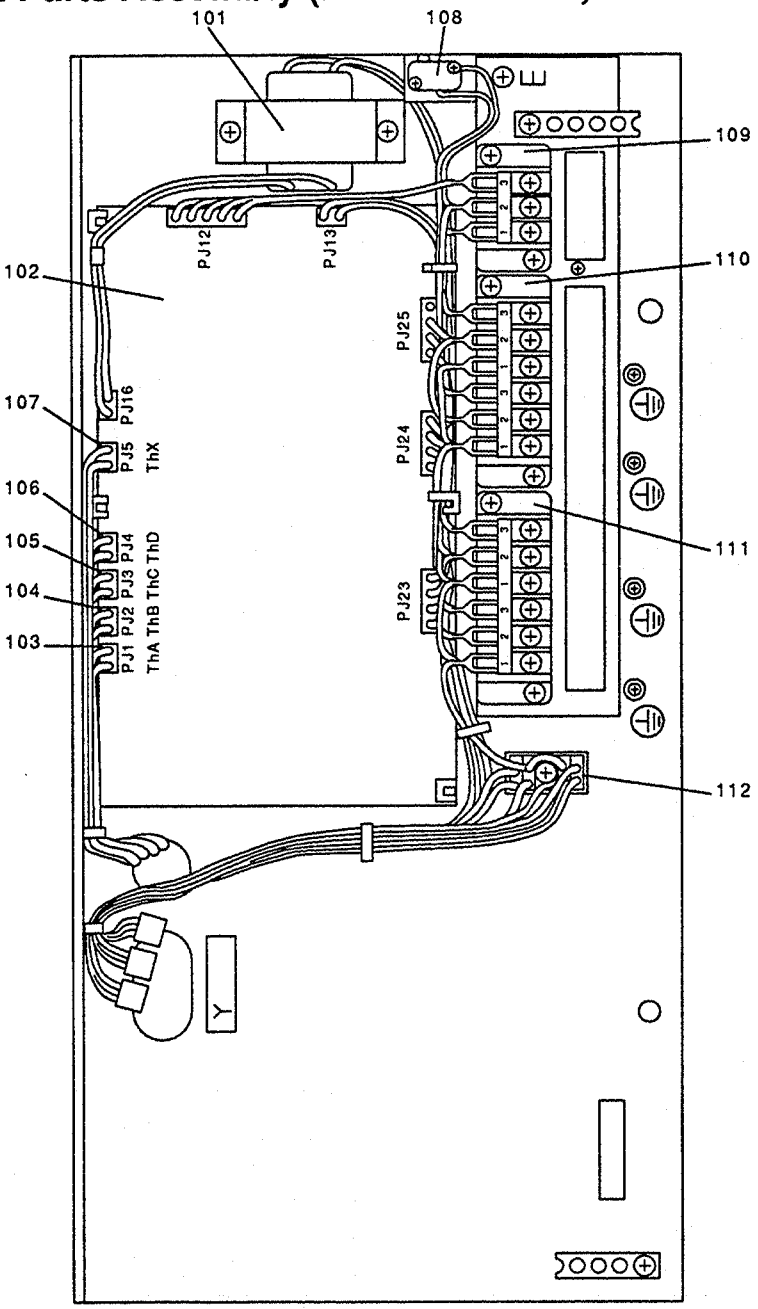
25-3. Multi-Controller (RBM-Y1031FE, RBM-Y1041FE)



Location No.	Part No.	Description
1	43019604	Holder, Sensor
2	43146443	Solenoid Coil
3	43046151	2-Way Valve
4	43046156	Check Valve
5	43046269	Pulse Motor Valve
6	43046270	2-Way Valve
7	43047527	Capillary Tube 2.0 Diameter
8	43060229	Fuse, 1A
9	43146283	Check Valve
10	43146398	Valve Body
11	43146506	Solenoid Coil
12	43146429	Expansion Valve
13	43146505	2-Way Valve
14	43151231	Float Switch
18	43157252	Panel Heater (RBM-Y1041FE)

Location No.	Part No.	Description
19	43157253	Panel Heater (RBM-Y1031FE)
21	43179086	Cap
22	43189026	Insulator, Liquid-A
23	43189027	Insulator, Liquid-B
24	43189028	Insulator, Header-A (RBM-Y1041FE)
25	43189029	Insulator, Header-A (RBM-Y1031FE)
27	43189031	Insulator, Header-B (RBM-Y1041FE)
28	43189032	Insulator, Header-B (RBM-Y1031FE)
30	43197141	Decoration Bolt
31	44246235	Capillary Tube 0.8 Diamer
32	44246236	Capillary Tube 1.0 Diameter

25-4. Electrical Parts Assembly (RBM-Y1041FE, RBM-Y1031FE)



Location No.	Part No.	Description
101	43158128	Transformer FT56
102	43169627	PC Board Assembly
103	43150162	Sensor
104	43150163	Sensor
105	43150164	Sensor
106	43150165	Sensor (RBM-Y1041FE)
107	43150166	Sensor
108	43151195	Switch, Micro

Location No.	Part No.	Description
109	43060750	Terminal Block, 3P
110	43160398	Terminal Block, 6P (RBM-Y1041FE)
110	43160399	Terminal Block, 3P (RBM-Y1031FE)
111	43160397	Terminal Block, 6P
112	43060776	Terminal

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TOSHIBA CORPORATION
1-1, SHIBAURA 1-CHOME, MINATO-KU, TOKYO 105, JAPAN

TOSHIBA

FILE NO. A13-9602
SUPPLEMENT

TOSH-02068

SERVICE MANUAL

AIR-CONDITIONER

SUPER MULTI COOL/HEAT FLEX SERIES

(OUTDOOR UNIT)

MAR-F81HTM8-E
MAR-F101HTM8-E

(MULTI-CONTROLLER)

RBM-Y1031FE-E
RBM-Y1041FE-E

– SUMMARY –

Use this supplement together with the original service manual File No. 300-950.

PRINTED IN JAPAN, July, 1996 (So)

CONTENTS

1. SPECIFICATIONS 3

2. ELECTRICAL PARTS SPECIFICATIONS 4

3. CONNECTIONS OF CONTROL WIRES BETWEEN UNITS 7

4. EXPLODED VIEWS AND PARTS LIST 8

1. SPECIFICATIONS OF OUTDOOR UNIT

Model Name			MAR-F81HTM8-E	MAR-F101HTM8-E
Cooling capacity (★1)		(kW)	20.0 (22.4)	25.0 (28.0)
Heating capacity (★1)		(kW)	20.0 (25.0)	25.0 (31.5)
Power supply (★2)			380 – 415V 3-phase 50Hz	
Cooling	Operating current	(A)	12.3 (14.0)	15.7 (17.2)
	Power consumption	(W)	8,000 (9,200)	10,100 (11,500)
	Power factor	(%)	94 (95)	93 (96)
Heating	Operating current	(A)	11.7 (15.3)	15.0 (20.0)
	Power consumption	(W)	7,700 (10,100)	10,100 (13,600)
	Power factor	(%)	95 (95)	97 (98)
Starting current		(A)	60	
Starting method			Direct	
Dimensions (H x W x D)		(mm)	1,490 x 1,290 x 750	1,490 x 1,290 x 750
Net weight		(kg)	330	340
Finished color			Silky gray (Munsell 6Y7/0.3)	
Compressor	Type		Hermetically sealed	
	Motor output	(kW)	5.6	7.5
Fan unit	Fan		Propeller fan	
	Motor output	(kW)	0.15 x 2	
	Air flow volume	(m^3/h)	10,000	
Refrigerant (charged weight)		(kg)	R-22 (17.6)	R-22 (21.6)
Discharge gas side		(mm)	ø19	
Liquid side		(mm)	ø15.9	
Suction gas side		(mm)	ø25.4	ø28.6
Coupler style			Flare connection (liquid side/discharge gas side), Brazing connection (suction gas side)	
Max. equivalent piping length		(m)	120	
Max. actual piping length		(m)	100 : The equivalent length is the base if there are too many bends.	
Max. piping head		(m)	50 : In case of outdoor unit installed above, 20 : In case of outdoor unit installed below.	
Crank case heater		(W)	74	

Note: ★1: Cooling/Heating capacity is based on JIS B 8615. The value marked by ( ) means operation at maximum capacity.

★2: Power voltage, if it varies, should be within a 10% range.

Specifications are subject to change without notice.

2. ELECTRICAL PARTS SPECIFICATIONS

2.1 Specifications of Refrigerant Cycle Parts

Model Name			MAR-F81HTM8-E	MAR-F101HTM8-E
Comp-ressor motor	Model name		HV991CW-Y12	HV1201CW-Y12
	Motor type		3-phase induction motor	
	Power supply		380 – 415V, 3-phase. 50Hz	
	Output	(kW)	5.6	7.5
	Pole	(P)	2/2 (Inverter side/Non-inverter side)	
	Coil resistance	(Ω)	1.49/2.51 (Inverter side/Non-inverter side)	
	Compressor oil name		SUNISO 3GSD	
	Amount of oil		7,000cc	
Blower motor	Model name		STF-200-150C	
	Motor type		1-phase, induction motor	
	Power supply		220 – 240V, 1-phase. 50Hz	
	Output	(W)	150	
	Power supply	(A)	1.12/1.44	
	Pole	(P)	6	
	Inner over-load relay		OFF:115±5°C	
High pressure switch	Model name		20PS-B/20PS-G (Inverter side/Non-inverter side)	
	Operating pressure	(kg/cm^2G)	OFF: 30, ON: 23/OFF: 23, ON: 30	
Low pressure switch	Model name		20PS-1	
	Operating pressure	(kg/cm^2G)	ON: 1.5, OFF: 0.25	
4-way valve			V25-760B	
Compressor case heater			AC 240V, 74W	
Pressure sensor			Model name: NTP-Q250TF-2 Input voltage: DC 12V Output voltage: DC 0.5 – 4.5V	
Discharge temperature sensor			25°C: 50kΩ, 50°C: 17.9kΩ, 100°C: 3.35kΩ	
Suction temperature sensor			0°C: 32.8kΩ, 25°C: 10kΩ, 50°°C: 3.6kΩ	
Outdoor air temperature sensor			0°C: 32.8kΩ, 25°C: 10kΩ, 50°C: 3.6kΩ	
Flow rate adjustment valve			EV23RC8, Coil DC 12V	
Flow rate adjustment valve (for bypass)			EV18RC2, Coil DC 12V	
2-way valve			(RP-100-03), Coil AC 240V	
2-way valve			NEV202DXF, Coil AC 240V	

Specifications are subject to change without notice.

2.2 Specifications of Inverter Assembly Parts

Model Name	MAR-F81HTM8-E	MAR-F101HTM8-E
Power supply	380 – 415V, 3-phase, 50Hz	
Output voltage at operating frequency of 60Hz	AC 266V	
IGBT	MG50Q6ES11	
Relay	LY1F (AC 240V)	
Blower motor running capacitor	EAG45M605UF1, 6μF450V	
Rectifier	30U6P42, 30A	
AC noise filter	ZSG2208-02, 8A, 250V	
DC noise filter	LF215AV, 15A, 716V	
Power supply rectifier capacitor	LNT2G222KSMCTF, 2200μF/400V	
Fuse	20A	
Electronic starter	912X25E101YV20	
Reactor	CH-26-T, 6.2mH, 18A	
Fan motor relay	G2R217PV	
Control relay	G4U-112P	
Magnetic contactor for compressor (Inverter side)	13A	
Magnetic contactor for compressor (Non-inverter side)	12A	15A
Transformer (Inverter)	FT70	
Transformer (Interface)	FT69	
Power supply terminal plate	AC 600V, 60A	
PC board (Inverter)	MCC-1251	
PC board assembly (Interface)	MCC-1223	
Cooling fan	3560EXV-5, 220 – 240V	

Specifications are subject to change without notice.

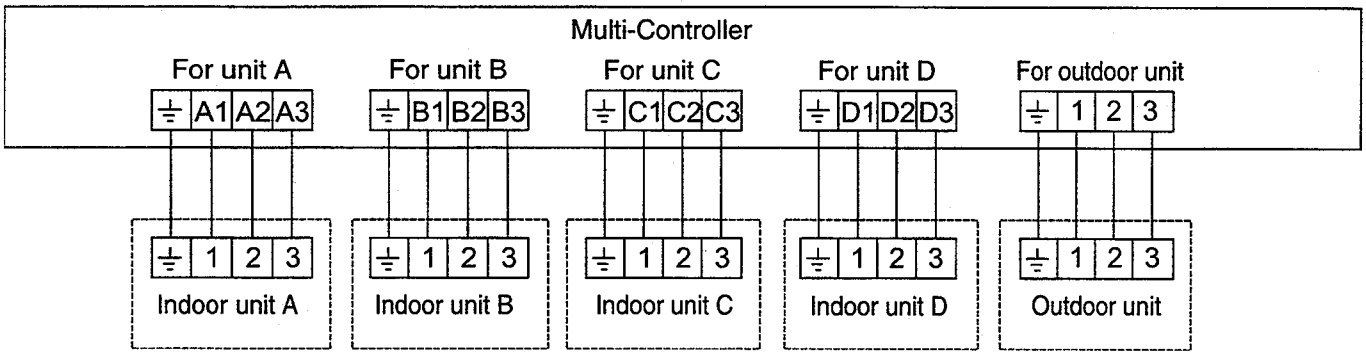
2.3 Specifications of Multi-controller Parts

Model Name		RBM-Y1031FE-E	RBM-Y1041FE-E
Flow rate adjustment valve		EV23RC7, Coil DC 12V	
Temperature sensor		0°C: 32.8kΩ, 25°C: 10kΩ, 50°C: 3.6kΩ	
Float switch		FS-085-0031	
Power supply transformer	Model name	FT69	
	Specification	Primary side: AC 240V, Secondary side: AC 12V	
Relay (on PC board)		G2R-117P, Coil DC 12V	
Heater		10.4W/m	
		50W	65W
Temperature fuse for heater		OFF: 119°C	
Power current fuse for heater		1A	
Discharge gas side solenoid valve		RP100-03, Coil AC 240V	
Suction gas side solenoid valve		REV-1506DXFQ6, Coil AC 240V	
2-way valve		NEV202DXF, Coil AC 240V	
2-way valve		NEV603DXF, Coil AC 240V	

Specifications are subject to change without notice.

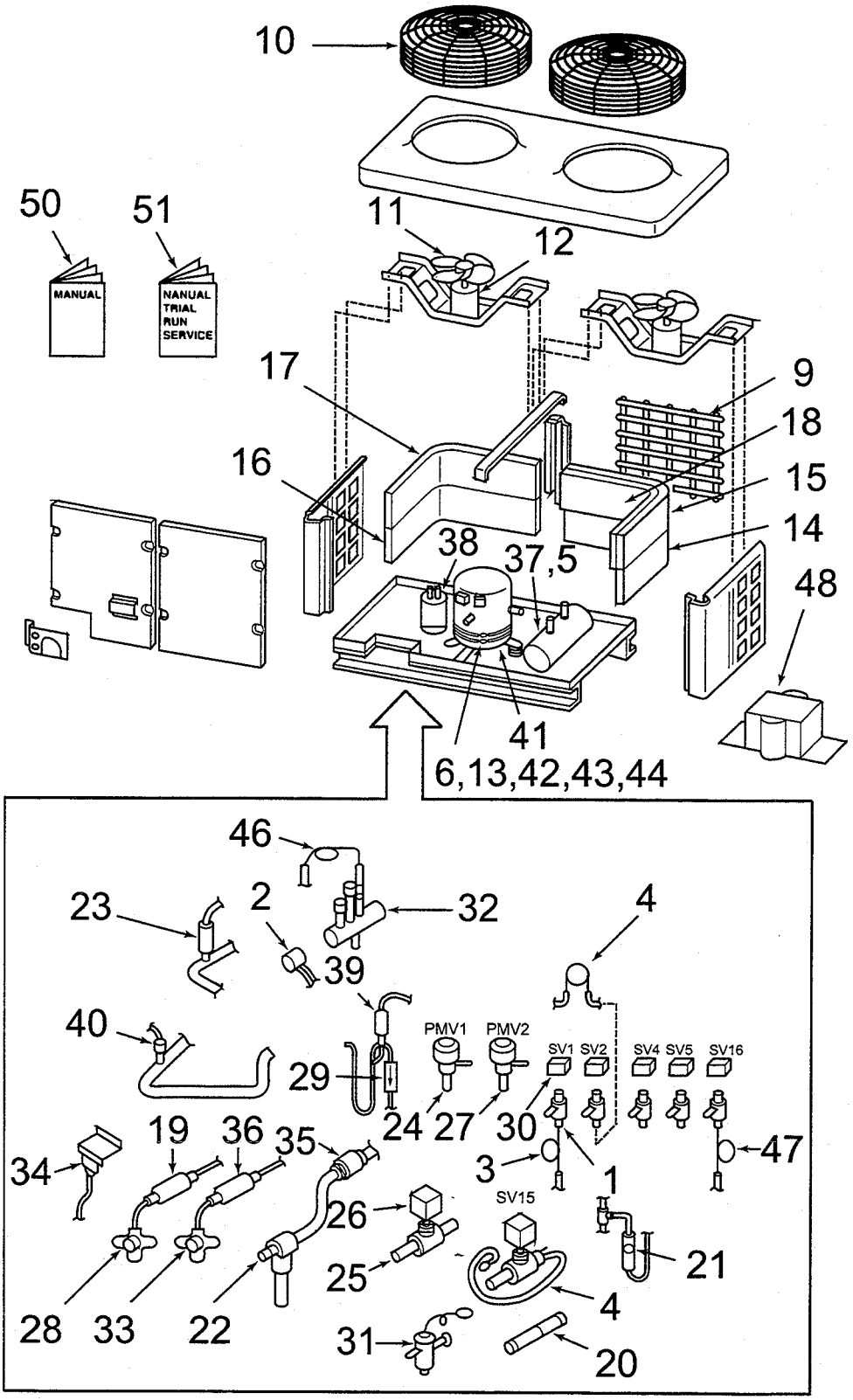
3. CONNECTIONS OF CONTROL WIRES BETWEEN UNITS

Check that the control wires between the indoor units and multi-controller and between the multi-controller and outdoor unit are properly connected. Check to see the terminal numbers for the control wires.



4. EXPLODED VIEWS AND PARTS LIST

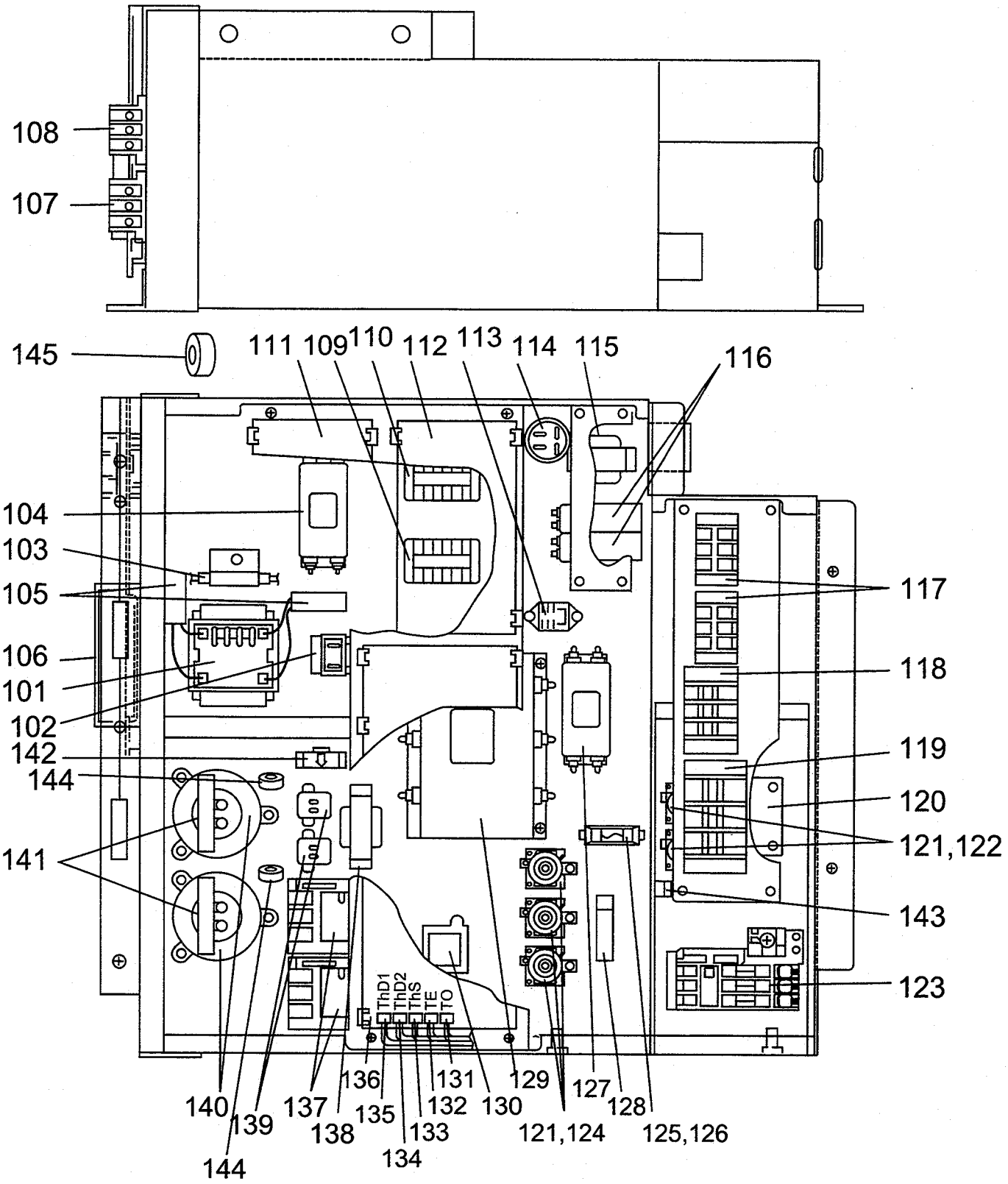
4.1 Outdoor Units (MAR-F81HTM8-E, MAR-F101HTM8-E)



Location No.	Part No.	Description
01	43046151	2-Way Valve
02	43046255	Solenoid Coil, 4-Way Valve
03	43047491	Capillary Tube 1.5 Diameter
04	43047527	Capillary Tube 2.0 Diameter
05	43048009	Fusible Plug
06	43107200	Spring, Base
09	43119391	Fin Guard
10	43119431	Fan Guard
11	43120170	Propeller Fan
12	43121545	Fan Motor, STF-200-150C
13	43141606	Compressor, HV991CW-Y12 (MAR-F81HTM8-E)
13	43141705	Compressor, HV1201CW-Y12 (MAR-F101HTM8-E)
14	43143572	Condenser, Right-Lower (MAR-F81HTM8-E)
14	43143557	Condenser, Right-Lower (MAR-F101HTM8-E)
15	43143573	Condenser, Right-Upper (MAR-F81HTM8-E)
15	43143558	Condenser, Right-Upper (MAR-F101HTM8-E)
16	43143574	Condenser, Left-Lower (MAR-F81HTM8-E)
16	43143559	Condenser, Left-Lower (MAR-F101HTM8-E)
17	43143575	Condenser, Left-Upper (MAR-F81HTM8-E)
17	43143560	Condenser, Left-Upper (MAR-F101HTM8-E)
18	43143576	Condenser, Sub (MAR-F81HTM8-E)
18	43143562	Condenser, Sub (MAR-F101HTM8-E)
19	43145066	Dryer

Location No.	Part No.	Description
20	43146252	Check Valve
21	43146283	Check Valve
22	43146351	Service Valve
23	43146367	Switch, High Pressure
24	43146525	Pulse Motor Valve
25	43146398	Valve Body
26	43146506	Solenoid Coil
27	43146526	Pulse Motor Valve
28	43146503	Packed Valve (5/8")
29	43146428	Check Valve
30	43146443	Solenoid Coil
31	43146427	Expansion Valve (MAR-F81HTM8-E)
31	43146444	Expansion Valve (MAR-F101HTM8-E)
32	43146446	4-Way Valve
33	43146504	Packed Valve (3/4")
34	43146524	Sensor, Pressure
35	43147529	Strainer
36	43147537	Strainer
37	43148123	Liquid Tank (MAR-F81HTM8-E)
37	43148120	Liquid Tank (MAR-F101HTM8-E)
38	43148122	Accumulator (MAR-F81HTM8-E)
38	43148121	Accumulator (MAR-F101HTM8-E)
39	43151229	Switch, High Pressure
40	43151230	Switch, Low Pressure
41	43157254	Heater, Crank Case
42	43195185	Cushion, Under, Compressor
43	43195186	Cushion, Under, Compressor
44	43195198	Spacer
46	44246235	Capillary Tube 0.8 Diameter
47	44246236	Capillary Tube 1.0 Diameter
48	43155136	Reactor
50	4318S018	Owner's Manual
51	4318S019	Manual, Trial Run and Service

4.2 Electrical Parts Assembly (MAR-F81HTM8-E, MAR-F101HTM8-E)

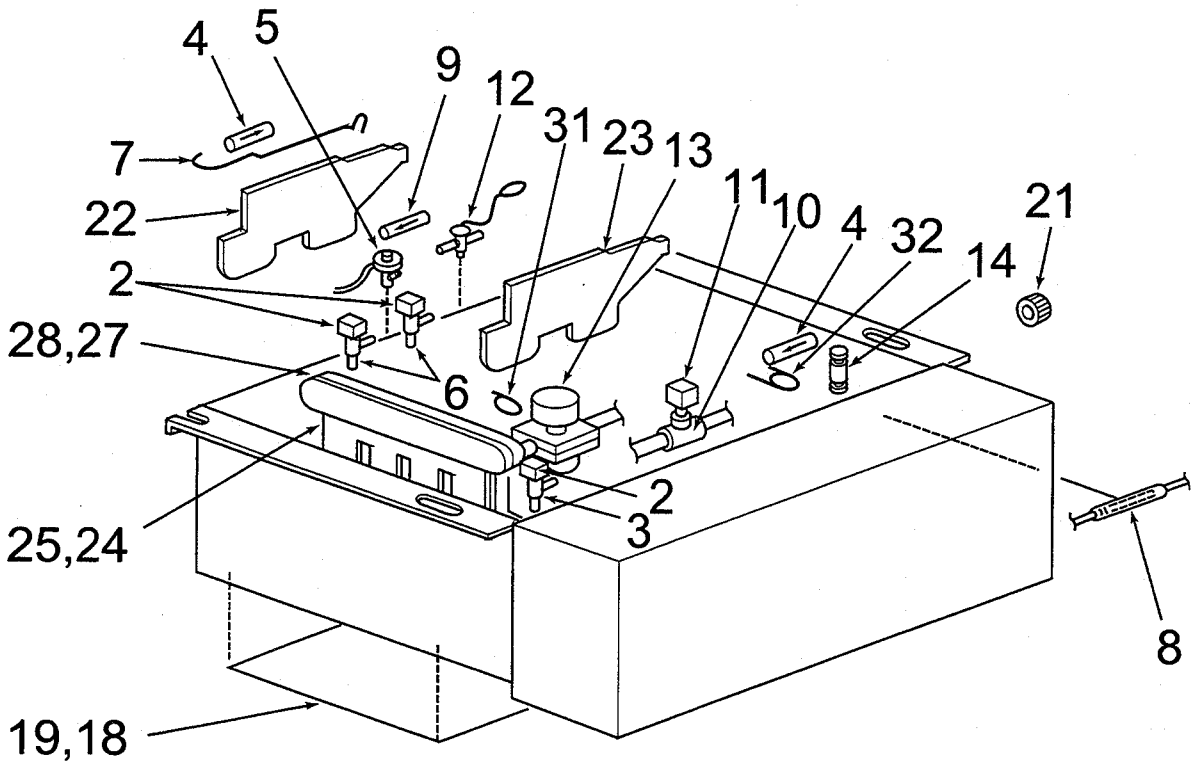


Location No.	Part No.	Description
101	43131031	G-Transistor, MG50Q6ES11
102	43169622	Rectifier, 30U6P42
103	43150214	TRS-Thermostat, TRC TR-100B10SPT3A
104	43169617	Noise Filter, DC
105	43169619	Diode Clipper Assembly
106	43169613	Fan Motor
107	43160438	Terminal
108	43160450	Terminal, 3P (L1, L2)
109	43160447	Terminal, 6P
110	43160448	Terminal, 6P
111	43169624	PC Board, MCC-1252, Gate
112	43169623	PC Board, MCC-1251, Control
113	43154156	Relay, LY-1F
114	43155135	Noise Filter
115	43158140	Transformer, FT70
116	43155134	Capacitor, MF
117	43060492	Terminal Block, 9P
118	43160449	Terminal, 3P (N)
119	43160426	Terminal Block, 3P (RST)
120	43169625	PC Board, MCC-1253, Surge
121	43160451	Holder, Fuse
122	43160452	Fuse
123	43142312	Magnetic Contactor (MAR-F81HTM8-E)

Location No.	Part No.	Description
123	43152356	Magnetic Contactor (MAR-F101HTM8-E)
124	43160453	Fuse
125	43460526	Fuse
126	43060859	Fuse Block
127	43169618	Noise Filter
128	43169620	Ferrite Core
129	43169616	Noise Filter, AC
130	43154148	Return Lock STR-4AB
131	43150272	TC Sensor
132	43150273	TC Sensor
133	43150271	TC Sensor
134	43150275	Sensor
135	43150274	Sensor
136	43169628	PC Board, MCC-1223, Interface
137	43152334	Magnetic Contactor
138	43158139	Transformer, FT69
139	43169612	Starter
★140	43169621	Capacitor, LNT2G222KSMCTF
141	43169614	SEM Resistor
142	43169615	Hole-CT
143	43055392	Surge Absorber
144	43160493	Clamp Filter
145	43160494	Clamp Filter

★ **Note:** Replace both two capacitors at a time.

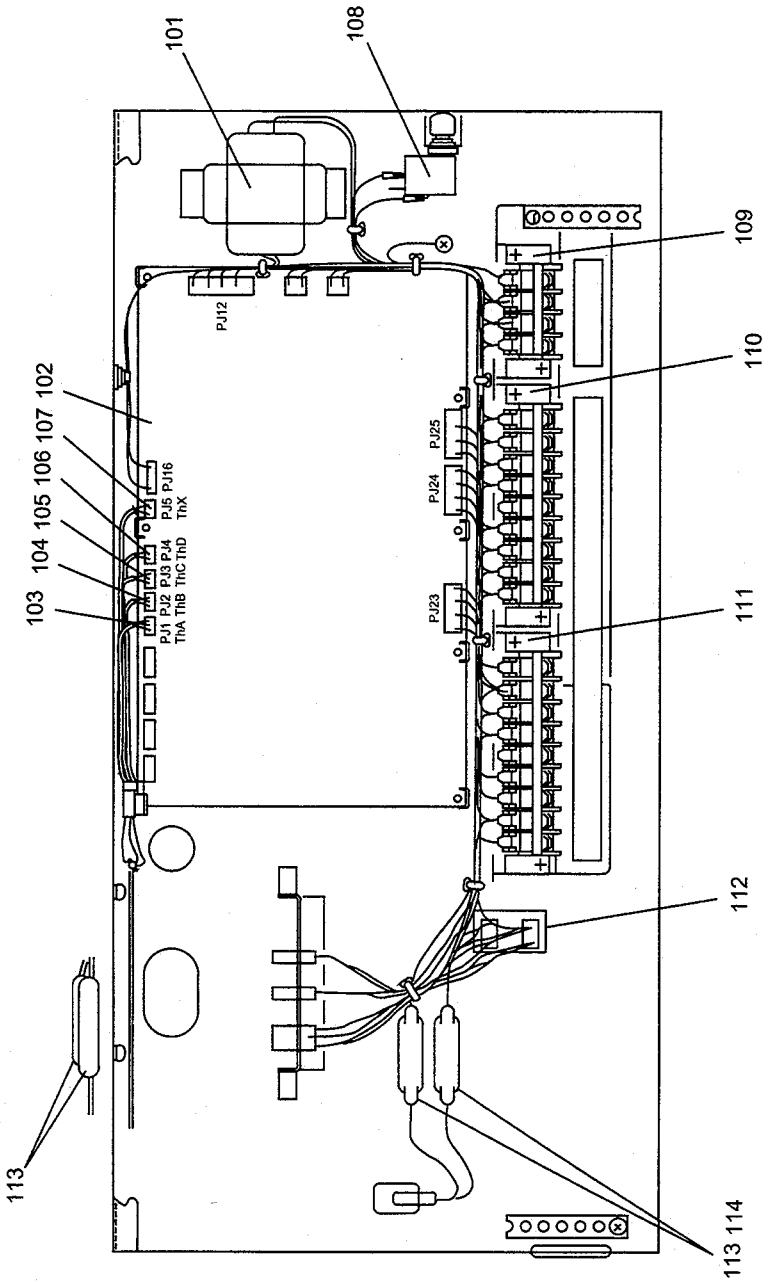
4.3 Multi-Controller (RBM-Y1031FE-E, RBM-Y1041FE-E)



Location No.	Part No.	Description
01	43019604	Holder, Sensor
02	43146443	Solenoid Coil
03	43046151	2-Way Valve
04	43046156	Check Valve
05	43046527	Pulse Motor Valve
06	43046270	2-Way Valve
07	43047527	Capillary Tube 2.0 Diameter
08	43060229	Fuse, 1A
09	43146283	Check Valve
10	43146398	Valve Body
11	43146506	Solenoid Coil
12	43146429	Expansion Valve
13	43146505	2-Way Valve
14	43151231	Float Switch
18	43157252	Panel Heater (RBM-Y1041FE-E)

Location No.	Part No.	Description
19	43157253	Panel Heater (RBM-Y1031FE-E)
21	43179086	Cap
22	43189026	Insulator, Liquid-A
23	43189027	Insulator, Liquid-B
24	43189028	Insulator, Header-A (RBM-Y1041FE-E)
25	43189029	Insulator, Header-A (RBM-Y1031FE-E)
27	43189031	Insulator, Header-B (RBM-Y1041FE-E)
28	43189032	Insulator, Header-B (RBM-Y1031FE-E)
31	44246235	Capillary Tube 0.8 Diameter
32	44246236	Capillary Tube 1.0 Diameter

4.4 Electrical Parts Assembly (RBM-Y1031FE-E, RBM-Y1041FE-E)



Location No.	Part No.	Description
101	43158139	Transformer
102	43169627	PC Board Assembly
103	43150266	Sensor
104	43150267	Sensor
105	43150268	Sensor
106	43150269	Sensor (RBM-Y1041FE-E)
107	43150270	Sensor
108	43151242	Micro-Switch

Location No.	Part No.	Description
109	43060488	Terminal 4P
110	43160489	Terminal 4P (RBM-Y1031FE-E)
110	43160491	Terminal 9P (RBM-Y1041FE-E)
111	43160490	Terminal 9P
112	43060776	Terminal
113	43060229	Fuse, 1A
114	43060859	Fuse-Block